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THIRTY-NINTH ANNUAL REPORT

OF THE

NEW JERSEY STATE

Agricultural Experiment Station

AND THE

THIRTY-FIRST ANNUAL REPORT

OF THE

New Jersey Agricultural College Experiment Station

FOR THE YEAR ENDING JUNE 30

1918

Union Hill, N. J.
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New Jersey Agricultural Experiment Stations*

NEW BRUNSWICK, N. J.

STATION ESTABLISHED 1880

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Somerset	Joseph Larocque	Bernardsville
Sussex	Robert V. Armstrong	Augusta
Union	John Z. Hatfield	Scotch Plains
Warren	James I. Cooke	Delaware

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Carl R. Woodward, B. Sc........... Editor.
Hazel H. Moran.................... Assistant Librarian.

Frank App, B. Sc..............Agronomist.
Irving L. Owen, B. Sc..Associate Agronomist
J. Marshall Hunter, B. Sc., Animal Husbandman.
Charles S. Cathcart, M. Sc........Chemist.
Ralph L. Willis, B. Sc....Assistant Chemist.
Archie C. Wark......Laboratory Assistant.
W. Andrew Cray....Sampler and Assistant.
Harry C. McLean, Ph.D..Chemist, Soil Res'h.
William M. Regan, A. M..Dairy Husbandman
Forest Button, B. Sc., Assistant Dairy Husbandman.
John Hill, B. Sc., Assistant Dairy Husbandman.
Thomas J. Headlee, Ph. D..Entomologist
Chas. S. Beckwith, B. Sc., Asst. Entomologist
Mitchell Carroll, B. Sc..Asst Entomologist.

Charles H. Connors, B. Sc., Assistant in Experimantal Horticulture.
Arthur J. Farley, B. Sc., Acting Horticulturist.
William Schieferstein....Orchard Foreman.
Lyman G. Schermerhorn, B. Sc., Specialist in Vegetable Studies.
Vincent J. Breazeale, Foreman, Vegetable Growing.
H. M. Biekart .... Florist.
Harry R. Lewis, M. Agr., Poultry Husbandman
Ralston R. Hannas, B. Sc., Assistant in Poultry Research.
Morris Siegel..............Poultry Foreman
Elmer H. Wene.............Poultry Foreman.
John P. Helyar, M. Sc........Seed Analyst.
Jessis G. Fiske, Ph. B....Asst. Seed Analyst.

AGRICULTURAL COLLEGE STATION, ESTABLISHED 1888.

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Jacob G. Lpman, Ph. D., Soil Chemist and Bacteriologist.
Augustine W. Blair, A. M., Associate Soil Chemist.
Selman A. Waksman, Ph. D., Microbiologist Soil Research.
Cyrus Witmer....Field and Laboratory Asst.

---

*Staff list revised to October 1, 1918.

NEW JERSEY STATE AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF AGRICULTURAL EXTENSION
ORGANIZED 1912

AND

NEW JERSEY STATE AGRICULTURAL COLLEGE
DIVISION OF EXTENSION IN AGRICULTURE AND HOME ECONOMICS
ORGANIZED 1914

Alva Agee, M. Sc, Director.

Mrs. Frank App, Assistant Home Demonstration Leader.

Victor G. Aubry, B. Sc., Specialist, Poultry Husbandry.

John W. Bartlett, B. Sc., Specialist, Dairy Husbandry.

Maurice A. Blake, B. Sc., Acting State Superintendent and State Leader of Farm Demonstration.

Roscoe W. DeBaun, B. Sc., Specialist, Market Gardening.

J. B. R. Dickey, B. Sc., Specialist Soil Fertility and Agronomy.

Elsie Ditmar, Assistant State Club Leader.

Marjory Eells, D. S., Home Demonstration Agent.

Edna Gulick, Home Demonstration Agent.

Arthur M. Hulbert, State Leader of Boys' and Girls' Club Work.

Ethel Jones, M. A., Asst. State Club Leader.

William F. Knowles, A. B., Assistant State Club Leader.

Van E. Leavitt, Specialist, Fruit Growing.

William M. McIntyre, Assistant Specialist, Fruit Growng.

Charles H. Nissley, B. Sc., Specialist, Fruit and Vegetable Growing.

Carl R. Woodward, B. Sc., Editor.

H. E. Baldinger, B. Sc., Demonstrator for Sussex County.

William P. Brodie, B. Sc., Demonstration Agent, Salem County.

Frank A. Carroll, Demonstrator for Mercer County.

Elwood L. Chase, B. Sc., Demonstrator for Gloucester County.

Laura V. Clark, A. B., Home Demonstration Agent for Newark.

Bertha Cold, B. Sc., Home Demonstration Agent for Jersey City.

Louis A. Cooley, B. Sc., Demonstration Agent for Ocean County.

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Cora A. Hoffman, B. Sc., Home Demonstration Agent for Morris County.

Willam A. Houston, Assistant Demonstration Agent for Sussex County.

Lauretta P. James, B. Sc., Home Demonstration Agent for Mercer County.

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May D. Kemp, B. Sc. Home Demonstration Agent for the Oranges.

Harvey S. Lippincott, B. Agr., Demonstrator for Morris County.

L. F. Merrill, B. Sc., Demonstrator for Bergen County.

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Caroline R. Simons, Home Demonstration Agent for Camden.

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Carolyn F. Wetzel, Home Demonstration Agent for Bergen County.

Albert E. Wilkinson, M. Agr., Demonstration Agent for Atlantic County.

Letter of Transmittal

To His Excellency, Walter E. Edge, Governor of the State of New Jersey:

SIR—I have the honor to submit herewith the Thirty-Ninth Annual Report of the New Jersey State Agricultural Experiment Station, as required by the law establishing the Station, which was approved March 10, 1880, and which is chapter 106 of the laws of that year

JAMES NEILSON,
President.

NEW BRUNSWICK, N. J., JULY 31,, 1918.

To His Excellency, Walter E. Edge, Governor of the State of New Jersey:

SIR—In compliance with an act of Congress, approved March 2, 1887, and with an act of the Legislature of this State approved March 5, 1888, I beg leave to submit, on behalf of the Trustees of Rutgers College in New Jersey, maintaining Rutgers Scientific School, the New Jersey State College for the benefit of Agriculture and Mechanic Arts, the Thirty-first Annual Report of the operations of the department of the College which has been organized in accordance with said act of Congress, and is known as "The State Agricultural College Experiment Station."

W. H. S. DEMAREST,
President.

NEW BRUNSWICK, N. J., JULY 31, 1918.

Treasurer's Report

Irving E. Quackenboss, in account with the New Jersey State Agricultural Experiment Station, November 1st, 1917, to June 30th, 1918.*

Appropriation for Salaries and Expenses

Appropriation	$30,000.00
Collections for Sales of Milk, Cream, and Dairy Stock, Glassware Tested, and Milk Testers' Licenses Issued	7,941.95
Collections for Sales of Swine	5,404.51
Collections for Sales of Peaches	692.17
Total	$44,038.63

PAYMENTS

By Treasurer of the Experiment Station		
Salaries and Wages		$17,567.28
Bills submitted to State Comptroller for direct payment		
Chemical Supplies	$106.60	
Coal, Oil, and Gasoline	8.51	
Electric Current	583.08	
Express, Freight, and Cartage	778.91	
Extra Hour and Day Labor	1,541.66	
Farm Machinery and Tools	557.05	
Feed and Shavings	6,742.39	
Fertilizers	1,216.50	
Gas	73.06	
Insurance	247.68	
Office Furniture and Equipment	597.93	
Photographic Supplies and Blue Prints	187.90	
Postage	943.34	
Registration of Animals	18.00	
Repairs	768.72	
Scientific Apparatus	393.54	
Small Printing and Stationery	735.19	
Team Hire	108.00	
Telephone and Telegraph	778.12	
Traveling Expenses—Officers	928.25	
Traveling Expenses—Sampling Feeds and Fertilizers	600.03	
Trees, Seeds, and Vines	15.33	
Veterinary Services and Medicine	131.53	
Water and Ice	15.00	
Sundries	485.18	
	$36,128.78	
Amount reserved by requisition until next fiscal year	1,415.32	
Amount reverting to State Treasury	6,494.53	
Total	$44,038.63	

---

*By legislative enactment, the fiscal year of the State has been changed. Hereafter the fiscal year will begin July 1st and end June 30th. The balance of the appropriations not used has been allowed to revert into the State Treasury.

Appropriation for Printing Bulletins

Appropriation	$7,000.00

PAYMENTS

Bills submitted to State Comptroller for direct payment for Printing Bulletins	2,359.65
Amount reserved by requisition until next fiscal year	2,289.00
Amount reverting to State Treasury	2,351.35
Total	$7,000.00

Appropriation for the Purpose of Carrying into Effect "An Act to Provide for Locating and Abolishing Mosquito-Breeding Salt Marsh Areas within the State, for Assistance in Dealing with Certain Inland Breeding Places, and appropriating Money to Carry its Provisions into Effect."

Appropriation	$15,000.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	2,510.00
Bills submitted to State Comptroller for direct payment	
Advertising	34.44
Extra Hour and Day Labor	47.20
Photographic Supplies and Blue Prints	106.25
Postage	40.00
Repairs	59.76
Telephone	9.00
Traveling Expenses—Officers	572.36
Sundries	.20
	$3,379.21
Amount reserved by requisition until next fiscal year	9,638.80
Amount reverting to State Treasury	1,981.99
Total	$15,000.00

Appropriation for the Scientific Investigation of Oyster Propagation

Appropriation	$900.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	100.00
Bills submitted to State Comptroller for direct payment	
Extra Hour and Day Labor	160.00
	$260.00
Amount reserved by requisition until next fiscal year	25.00
Amount reverting to State Treasury	615.00
Total	$900.00

Appropriation for the Maintenance and Operation of the Department of Poultry Husbandry

Appropriation	$7,500.00
Collection for Sales of Poultry and Eggs	5,967.71
Total	$13,467.71

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	5,575.02
Bills submitted to State Comptroller for direct payment	
Books and Magazines	9.00
Chemical Supplies	1.05
Extra Hour and Day Labor	210.70
Insurance	486.53
Office Furniture	69.15
Oil and Gasoline	4.50
Photographic Supplies and Blue Prints	54.12
Poultry Feed	3,734.74
Poultry Supplies and Tools	332.25
Printing and Stationery	18.35
Repairs	159.37
Telephone	.55
Traveling Expenses—Officers	356.90
Seed	4.50
Veterinary Services and Medicine	11.25
Sundries	46.48
	$11,074.46
Amount reserved by requisition until next fiscal year	245.03
Amount reverting to State Treasury	2,148.22
Total	$13,467.71

Appropriation for Carrying Out the Provision of "An Act Concerning Seeds"

Appropriation	$3,500.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	2,400.00
Bills submitted to State Comptroller for direct payment	
Office Supplies	11.85
Printing and Stationery	63.08
Repairs	6.00
Scientific Apparatus	5.69
Traveling Expenses—Officers	49.71
Sundries	7.31
	$2,543.64
Amount reverting to State Treasury	956.36
Total	$3,500.00

Appropriation for the Purpose of Maintaining and Carrying on Experimental Work in Floriculture

Appropriation	$3,500.00
Collections for Sales of Flowers	1,297.09
Total	$4,797.09

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	2,150.00
Bills submitted to State Comptroller for direct payment	
Books and Magazines	45.00
Coal	574.00
Extra Hour and Day Labor	208.30
Fertilizers	70.00
Floriculture Supplies and Tools	39.90
Insurance	57.60
Repairs	103.93
	$3,248.73
Amount reserved by requisition until next fiscal year	2.50
Amount reverting to State Treasury	1,545.86
Total	$4,797.09

Appropriation for Carrying Out the Provisions of "An Act to Regulate the Sale of Insecticides"

Appropriation	$1,000.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	240.00
Bills submitted to State Comptroller for direct payment	
Chemical Supplies	324.11
Scientific Apparatus	57.32
	$621.43
Amount reverting to State Treasury	378.57
Total	$1,000.00

Appropriation for Farm Demonstration in Agriculture

Appropriation	$28,000.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	17,046.72
Bills submitted to State Comptroller for direct payment	
Books and Magazines	1.25
Express, Freight and Cartage	5.71
Farm Machinery and Tools	1.65
Fertilizers	23.98
Office Furniture and Equipment	291.60

Printing and Stationery	1,322.75
Repairs	19.10
Scientific Apparatus	143.05
Telephone and Telegraph	373.10
Traveling Expenses—Officers	2,154.71
Seed	22.92
Sundries	25.92
	$21,432.46
Amount reserved by requisition until next fiscal year	47.88
Amount reverting to State Treasury	6,519.66
Total	$28,000.00

Appropriation for Cranberry Investigation

Appropriation	$1,500.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	485.00
Bills submitted to State Comptroller for direct payment	
Traveling Expenses—Officers	60.25
	$545.25
Amount reverting to State Treasury	954.75
Total	$1,500.00

Appropriation for Egg-Laying and Breeding Tests

Appropriation	$3,000.00

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	1,820.00
Bills submitted to State Comptroller for direct payment	
Extra Hour and Day Labor	174.38
	$1,994.38
Amount reverting to State Treasury	1,005.62
Total	$3,000.00

Appropriation for Repairs in Experiment Station Building

Appropriation	$600.00

PAYMENTS

Bills submitted to State Comptroller for direct payment	
Repairs in Experiment Station Building	535.17
Amount reverting to State Treasury	64.83
Total	$600.00

Appropriation for the Purchase of Tractors and other Farm Machinery

Appropriation	$2,000.00

PAYMENTS

Bills submitted to State Comptroller for direct payment	
Tractors and Farm Machinery	1,883.45
Amount reserved by requisition until next fiscal year	115.00
Amount reverting to State Treasury	1.55
Total	$2,000.00

Feed Inspection Fees Account

Appropriation—Collection of Feed Inspection Fees	$9,528.19

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	3,480.06
Bills submitted to State Comptroller for direct payment	
Chemical Supplies	34.00
Express, Freight and Cartage	391.87
Extra Hour and Day Labor	411.34
Farm Machinery and Tools	71.32
Feed	3,447.12
Fertilizers	6.75
Insurance	122.64
Office Supplies	31.40
Oil and Gasoline	8.10
Printing and Stationery	119.58
Registration of Animals	5.00
Repairs	418.85
Team Hire	36.00
Trees, Seeds, and Vines	394.98
Water and Ice	58.50
Sundries	30.70
	$9,068.21
Amount reserved by requisition until next fiscal year	422.60
Amount reverting to State Treasury	37.38
Total	$9,528.19

Fertilizer Inspection Fees Account

Appropriation—Collection of Fertilizer Inspection Fees	$26,600.13

PAYMENTS

By Treasurer of the Experiment Station	
Salaries and Wages	12,888.02
Bills submitted to State Comptroller for direct payment	
Books and Magazines	28.25
Chemical Supplies	164.25
Electric Current	138.62
Extra Hour and Day Labor	606.51
Farm Machinery and Tools	101.39
Feed	7,704.81

Fertilizers	375.20
Gas	18.34
Live Stock	800.00
Office Furniture and Equipment	30.00
Office Supplies	44.77
Photographic Supplies and Blue Prints	37.48
Postage	400.00
Printing and Stationery	175.96
Repairs	21.64
Scientific Apparatus	26.00
Telephone and Telegraph	409.97
Traveling Expenses—Officers	940.02
Traveling Expenses—Sampling Fertilizers and Feeds	325.83
Trees, Seeds, and Vines	141.20
Veterinary Services and Medicine	50.75
Water and Ice	106.18
Sundries	40.45
	$25,575.64
Amount reserved by requisition until next fiscal year	188.75
Amount reverting to State Treasury	835.74
Total	$26,600.13

SUMMARY

Total Appropriations	$103,500.00
Total Collections Credited to Appropriations	57,431.75
Total of all Appropriations and Collections credited to Appropriations	$160,931.75

Summary of Analysis of all Expenditures

Advertising	$34.44
Books and Magazines	83.50
Chemical Supplies	630.01
Coal, Oil and Gasoline	595.11
Electric Current	721.70
Express, Freight and Cartage	1,176.49
Extra Hour and Day Labor	3,360.09
Farm Machinery and Tools	2,937.01
Feed and Shavings	21,629.06
Fertilizers	1,692.43
Gas	91.40
Insurance	914.45
Live Stock	800.00
Office Furniture and Equipment	988.68
Photographic Supplies and Blue Prints	385.75
Postage	1,383.34
Printing Bulletins	2,359.65
Printing and Stationery	2,522.93
Registration of Animals	23.00
Repairs	2,092.54
Salaries and Wages	66,262.10
Scientific Apparatus	625.60

Team Hire	144.00
Telephone and Telegraph	1,570.74
Traveling Expenses—Officers	5,062.20
Traveling Expenses—Sampling Feeds and Fertilizers	925.86
Trees, Seeds, and Vines	578.93
Veterinary Services and Medicine	193.53
Water and Ice	179.68
Sundries	636.24
	$120,650.46
Amount reserved by requisition until next fiscal year	14,389.88
Amount reverting to State Treasury	25,891.41
Total	$160,931.75

Collections Account

RECEIPTS

From Poultry Department Collections for Sales of Poultry and Eggs	$5,967.71
From Floriculture Department Collections for Sales of Flowers	1,297.09
From Horticulture Department Collections for Sales of Peaches	692.17
From Dairy Department Collections for Sales of Milk, Cream, and Dairy Stock, Glassware Tested, and Milk Testers' Licenses Issued	7,941.95
From Swine Department Collections for Sales of Swine	5,404.51
From Chemical Department Collection of Feed Inspection Fees	9,528.19
From Chemical Department Collection of Fertilizer Inspection Fees	26,600.13
From Farm Demonstration Department Collections for Sales of Honey	45.72
Total	$57,477.47

PAYMENTS

To State Treasurer Collections for Sales of Poultry and Eggs	$5,967.71
To State Treasurer Collections for Sales of Flowers	1,297.09
To State Treasurer Collections for Sales of Peaches	692.17
To State Treasurer Collections for Sales of Milk, Cream, and Dairy Stock, Glassware Tested, and Milk Testers' Licenses Issued	7,941.95
To State Treasurer Collections for Sales of Swine	5,404.51
To State Treasurer Collection of Feed Inspection Fees	9,528.19

To State Treasurer Collection of Fertilizer Inspection Fees	26,600.13
To State Treasurer Collections for Sales of Honey	45.72
Total	$57,477.47

The Auditing Committee of the Experiment Station has examined the Accounts of the Treasurer of said Station, and has found them correct.

(Signed) WM. H. REID,
EGBERT T. BUSH,
Auditing Committee.

Financial Statement

New Jersey State Agricultural College Experiment Station in Account with The United States Appropriations, 1917-1918.

Dr.

	Hatch Fund	Adams Fund
To Receipts from the Treasurer of the United States as per appropriations for fiscal year ended June 30, 1918, under acts of Congress approved March 2, 1887 (Hatch Fund), and March 16, 1906 (Adams Fund)	$15,000.00	$15,000.00

Cr.

	Abstract	Hatch Fund	Adams Fund
Salaries	1	$8,777.01	$12,386.50
Labor	2	972.00	827.11
Publications	3	480.82	......
Postage and Stationery	4	604.92	10.41
Freight and Express	5	18.28	2.79
Heat, Light, Water and Power	6	574.70	285.42
Chemicals and Laboratory Supplies	7	258.80	417.99
Seeds, Plants and Sundry Supplies	8	347.42	95.60
Fertilizers	9	210.46	......
Feeding Stuffs	10	......	360.00
Library	11	11.19	......
Tools, Machinery, and Appliances	12	222.76	84.71
Furniture and Fixtures	13	267.29	22.25
Scientific Apparatus and Specimens	14	13.76	66.01
Live Stock	15	150.00	......
Traveling Expenses	16	1,509.28	......
Contingent Expenses	17	......	......
Buildings and Land	18	581.31	441.21
		$15,000.00	$15,000.00

We, the undersigned, duly appointed Auditors of the Corporation, do hereby certify that we have examined the books and accounts of the New Jersey State Agricultural College Experiment Station for the fiscal year ended June 30, 1918; that we have found the same well kept and classified as above; that the balance brought forward from the preceding year was $........on the Hatch Fund and $........on the Adams Fund; that the receipts for the year from the Treasurer of the United States were $15,000.00 under the act of Congress of March 2d, 1887, and $15,000.00 under the act of Congress of March 16th, 1906, and the corresponding disbursements $15,000.00 and $15,000.00; for all of which proper vouchers are on file and have been by us examined and found correct, thus leaving balances of $........ and $........

And we further certify that the expenditures have been solely for the purposes set forth in the acts of Congress approved March 2d, 1887, and March 16th, 1906, and in accordance with the terms of said acts, respectively.

(Signed) W. H. S. DEMAREST,
J. G. LIPMAN,
Auditors.

REPORT OF THE DIRECTOR

Report of the Director

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Report of the Director for 1918

JACOB G. LIPMAN

Competition of war industries has brought about marked changes in the farm practice of the past season. It happens that New Jersey has a large number of these war industries within its borders and many more in adjacent territory. Naturally, the scale of wages in vogue at plants manufacturing war supplies and equipment is very much beyond that formerly, and even at present, prevailing on the farms of the state. Experienced farm help has been attracted by the high wages and has been lost to the farms.

Not only is there a shortage of experienced farm labor, but much of the labor remaining on farms is, on the average, less competent than formerly. An effort has been made to replace the men who have left the farm by boys of school age and by women. This replacement is not in all cases satisfactory. Fortunately, cooperation on the part of the Commissioner of Labor of New Jersey, of the Federal Department of Labor and of the State Agricultural College has served to distribute as well as is practicable the scant supply of farm labor.

Much uncertainty has also prevailed in the supply and distribution of raw materials needed in crop production. The delivery of fertilizers was very slow in the spring and, in a number of instances, farmers were compelled to plant their crops without fertilizer which had failed to arrive in time. Similarly, the deliveries of farm implements, of seed and of insecticides has been uncertain. The price of these commodities also has gone up. Feed for domestic animals has increased in price to such an extent as to hamper seriously the feeding of poultry, swine and dairy animals. The farmers in our state are realizing that it will be necessary to place orders for raw materials used in crop production at a much earlier date than heretofore.

The disturbed condition of the farm labor market and the enhanced prices of farm supplies have brought about, in certain sections, a more or less far-reaching readjustment in the crop practice. In some of the South Jersey counties the acreage of potatoes was materially reduced and the acreage of tomatoes increased to a corresponding extent. On the whole, there has been an increase in the acreage of corn and of small grains, and a very marked decrease in the acreage of vegetable crops grown under normal conditions. There has been a marked decrease in the number of dairy cattle in the southern part of the state. There has also been a very marked shrinkage in the amount of poultry in the state. It may be noted here that home gardens still continue to be a factor in food production. The total acreage devoted to home gardens in 1918 is probably less than that in 1917. On the other hand, the gardens are evidently receiving much better care and the volume of food produced from these gardens should be fully as great in 1918 as it was in 1917.

It is already apparent that the unusual industrial conditions now prevailing will react on agriculture production in the state. It is safe to assume that there will be an extraordinary demand after the war for desirable farm lands and that many new settlers will come to New Jersey from other states. For this reason it would be wise to anticipate the utilization of farm lands now partly or entirely neglected and the putting under cultivation of a great deal of land not yet improved for farm purposes. Some stress will have to be laid on the desirability of organizing as fast as may be practicable agricultural courses in our secondary schools, for we shall depend on these courses for the training of a new generation of farmers. It may be suggested, also, that a greater degree of cooperation will be developed among farmers of New Jersey, both in respect to production and marketing.

THE STATION'S ACTIVITIES

The progress of the war has brought about some readjustments in the organization and conduct of the work of the Experiment Station. A very considerable number of the staff terminated their connection with the institution to enter the military service of the country. A list of former employees of the station now in the service is given elsewhere in this report. In so far as it was possible, vacancies created by enlistments or draft were filled by men above draft age or those placed in the deferred classes on account of dependents. Nevertheless, the increasing scale of salaries, a sequel to the high cost of food and of other commodities, has tended to interfere with the progress of the Station's work.

Among the accessions to the land, buildings and equipment of the station, there are several which are deserving of special mention. Mr. James Neilson—a trustee and tried friend of the College—has placed at the disposal of the College and Experiment Station his farm-land and outbuildings. There is a total area of about 260 acres owned by Mr. Nielson. Of this acreage 150 acres are tillable and in good state of cultivation. Mr. Neilson, with his usual generosity, is allowing the College the use of his land and outbuildings without charge. The increased acreage which was made available by Mr. Neilson's action made necessary the engaging of additional men for farm work and the purchase of additional equipment. An effort was made to solve the labor problem by putting in use three tractors owned by the Station. The excessive rainfall during the early part of the season interfered more or less with the fullest use of these tractors. Nevertheless, results thus far obtained indicate that the farm tractor may be made a valuable ally in general farming. In view of the high cost of feeds, as well as of labor involved in the care of live-stock, motor-driven farm machinery should prove an acceptable substitute for draft animals.

The completion of the Dairy Barn, so badly needed, has been delayed on account of the inability of the contractor to secure building materials. It is hoped that it will be completed before cold weather comes on. The completion of the barn will permit of a more economical use of the labor employed in our dairy department. It is expected that the new barn will be conducted as a commercial unit of about 45 milking cows, and that the old barn will be used for heifers and calves. A number of bull pens have been completed and enclosures provided for the young stock. All told, there has been very marked progress in the dairy department. The number of pure-bred and registered animals is steadily increasing, and the time is near when all of the livestock in the dairy department will be pure-bred. Three of the prominent breeds, viz.: Holstein, Jersey and Ayrshire, are well represented. The number of Guernseys in the herd is still very limited, but a good beginning with this breed has already been made. It may be noted here that several Milking Shorthorns were purchased last fall and that a few of these animals will be kept for educational purposes. It may also be noted that the flock of sheep acquired by the Station will be enlarged as conditions may permit.

Certain alterations are being made in the Short Course Building to provide for the establishment of a Home Economics Laboratory in which experimental and demonstration work in home economics may be carried on. This laboratory should be a valuable aid to the home economics specialists in the state, for it will give them an opportunity to test out recipes and methods before recommending them for general adoption in the state.

While every effort has been made to economize in the use of labor on the College Farm Grounds, some progress has been made nevertheless as incidental to the work of crop production. The lines of the first quadrangle of the College Farm have been marked by the planting of shade trees and by a limited degree of grading and filling. The approach to the College Farm is to be made more attractive by the paving of Nichol Avenue, now in progress. This work is being done by the Department of Highway Engineering of the state. It is the pleasant duty of the director of the Station to express his feeling of appreciation to the State Highway Department for the helpful cooperation extended to both the College and Station.

The constant demand for additional space on the part of the extension department of the College and Station has made it necessary to utilize a large part of the Farm House for this purpose. The offices of the state leader of boys' and girls' clubs, as well as the office of the home economics specialists, are now located in the Farm House. Notwithstanding the use of most of the Farm House for this purpose, the Agricultural Building is very much crowded and some of the departments of the Station are suffering from lack of adequate office facilities. It is hoped that the request of the College and Station for a Horticultural Building, repeatedly presented to the Appropriations Committee, will be met in the near future. There is also an urgent need for the construction of a machinery building, in which farm tractors and other farm machinery may be stored and in which instruction in farm mechanics may be carried on. It is realized that the growing interest in the use of motor-driven machinery will compel the agricultural institutions of the state to accumulate first-hand information on the construction and costs of operation of such implements and machinery. It is hoped that funds may be available for the construction of a Machinery Building.

Some of the research work of the Station has been curtailed on account of the lack of fuel. Two of the station green houses were not operated last winter in order that the consumption of coal might be reduced to a minimum. It is expected that through the coming fall and winter economy in the use of coal for greenhouse purposes will be even more rigid. In so far as possible, wood fuel will be used at the College Farm as a substitute for coal. In spite of the most drastic economy, however, very considerable quantities of coal will be needed for heating the offices and laboratories. We hope that this coal will be made available.

The rapidly mounting cost of supplies of all sorts is imposing on the station administration the duty of scrutinizing every item of expense in order that the station budget may be kept within the limits of the appropriation. The cost of feeds and of labor is an important item in the station budget and is, for this reason, receiving special consideration.

An effort is being made to increase the production of home-grown feeds. The production of alfalfa and of other forage crops is considerably beyond the actual needs of the livestock, and some hay will probably be sold. If the growing conditions remain at all normal, the production of corn should not only be sufficient for filling the silos, but should also furnish one-third of the corn needed by the dairy, poultry and animal husbandry departments of the station. A very considerable quantity of oats and peas will also be made available for furnishing part of the concentrates needed in the dairy and animal husbandry departments.

The Experiment Station has enjoyed within the period covered by this report the cooperation of the United States Department of Agriculture, and of the State Departments of Conservation and Development, Education, Labor and Agriculture. The station has also enjoyed the cooperation of the State Argricultural College and State University of New Jersey. Experimental work carried on in cooperation with the United States Department of Agriculture has included studies of plant diseases affecting tomatoes, the feeding of garbage to swine and the fertilizer requirements of soils especially adapted to the growing of cranberries and blueberries. The Department of Conservation and Development has cooperated, as formerly, with the Experiment Station in the conduct of soil surveys of the state. The State Department of Agrciulture has continued its cooperation in certain control work on insects and plant diseases, the organization of farmers' institutes and the carrying on of educational work relating to crops and animals.

The enactment of the so-called Smith-Hughes Bill has provided for cooperative work between the State Department of Education and the State University of New Jersey. Indirectly, this cooperative work affects the activities of the Experiment Station. The organization of agricultural courses in the secondary schools of the state, as a result of this cooperation, will bring to the Experiment Station a certain degree of responsibility in the supplying of technical information on crop production. The Experiment Station has enjoyed in many ways cooperation with the State University in the conduct of demonstration and experimental work. This cooperation allows the most economical use of buildings and equipment, and accrues to the advantage of both institutions.

A summary of the activities of the several departments of the station, as submitted by these departments, is herewith given.

CHEMISTRY

The previous annual reports contain the results of the inspections of feeding stuffs, fertilizers, agricultural lines and insecticides, but since this report is for only eight months, it is impossible to report in detail the results of all the inspections. The inspection of commercial feeding stuffs is the only inspection that has been completed since the last report, and the results obtained are noted. Brief statements also are made in regard to the other inspections in order that a record may be made of the conditions at the time of rendering the report.

Inspection of Commercial Feeding Stuffs

The manuscript for the bulletin containing the results of the inspection has been prepared and is in the hands of the printer.

During the year, 469 manufacturers and jobbers registered 2553 brands of feeding stuffs which they would offer for sale in this state. The inspectors found 39 brands that were being sold before registration was made. This is an improvement over the preceding year, the local manufacturers being largely responsible for these brands.

The total number of samples examined was 977, and 260—or 27.9 per cent—did not substantially satisfy the guarantees given for the minimum content of protein and fat, and the maximum content of fibre. The deficiencies found consisted of the following: protein, 87; fat, 83; and fiber, 151; 207 samples being deficient in one nutrient; 45 deficient in two nutrients and 8 deficient in the three nutrients. These figures, when compared with the previous inspection, show that there was an improvement in the character of the feeds examined.

The tonnage of feeding stuffs sold as shown in the tabulation amounts to 234,040 tons, which was about 1300 tons less than was sold during the preceding year and about 6000 tons more than was sold in 1915.

Inspection of Commercial Fertilizers

The collection of the samples of fertilizers representing the spring shipments has been made, and the chemical examinations are being made by the entire chemical force, but the work has not progressed sufficiently to permit any statements as to the character and composition of the materials sold.

Registration

The fertilizer registrations received between November 1, 1917, and January 28, 1918, were published in Bulletin 321.

Inspection of Agricultural Lime

The inspection of Agricultural lime products is being carried along with the fertilizer work as usual.

Inspection of Insecticides

Samples of insecticides are being collected. The chemical examination will be made and the results published as usual.

HORTICULTURE

The peach experiments in Orchard No. 1 at Vineland have been conducted for a period of ten years, and, since it is now very difficult and almost impossible to secure some forms of plant-food, this portion of the work has been concluded. The orchard, however, has become the oldest one in the district in commercial condition, and it offered a good opportunity to demonstrate the commercial possibilities of an orchard beyond its tenth year. Each alternate row of trees was pruned back severely in the last winter in order to develop a new top, and a vigorous growth resulted. The other rows will be headed back in the same manner either next year or the following year, so that the entire orchard may be kept vigorous and with low heads.

The extensive peach pruning experiments at Vineland have been continued and a full crop is now on the trees. Some detailed studies are being made this year of the rate of growth of the fruits and twigs in each treatment.

A record has been kept for a period of years of the number of borers removed from each tree in the experiments at Vineland, and this work has been maintained. The number of trees infested and the number of borers found were greatly reduced this year probably as the result of the work of parasites.

A white seeding freestone peach that ripens a few days before Carman is being propagated for distribution.

Several promising carnation seedlings deserve to be propagated for distribution as soon as conditions permit.

ANIMAL HUSBANDRY

Three distinct lines of feeding experiments received attention in the animal husbandry department during the period November 1, 1917, to June 30, 1918.

One of these feeding experiments consisted of a comparative study of self-feeders versus hand-feeding for market pigs that were allowed access also to forage crops. The second trial, a continuation of earlier experimental work, began on June 15, 1917, with 20 pigs; and the third trial began on July 25, 1917, with 30 pigs. All of the animals were under experiment from weaning time until ready to go to market. It is expected that a fourth test will be carried out in the season of 1918 in order to make certain that the results of the last two seasons are properly checked.

Cooperative experiments are being conducted on the feeding of garbage to hogs. The State Hospital, at Trenton, and the United States Department of Agriculture, as well as the Experiment Station, are participating in this work. The experimental work was begun on June 7, 1918, with 60 pigs. It is proposed to continue the experiments until the animals obtain a marketable weight of from 200 to 250 pounds. The 60 animals are divided into six lots of ten pigs each. They are to be fed as follows:

Lot 1. Cooked garbage.
Lot 2. Raw garbage.
Lot 3. Raw garbage finished on a grain ration.
Lot 4. Raw garbage with 1 per cent of grain.
Lot 5. Straight grain ration.
Lot 6. Raw garbage with green forage.

Still another experiment deals with alfalfa as a hay and forage crop. The alfalfa crop used in the experiment was seeded on August 14, 1917. The first cutting was made on May 27, 1918, and the animals were turned into the alfalfa pasture on June 10, 1918. An attempt will be made to determine the value of alfalfa in the economical production of pork.

POULTRY HUSBANDRY

The work of the department of poultry husbandry has progressed very satisfactorily during the past eight months in spite of the serious handicaps occasioned by war conditions. The change in the date of issuing the animal report makes it impossible to report fully on the details and progress of the various research projects. These will be fully reported upon in the next annual report.

The staff of the department has been subjected to many changes, due to demands for men for service in the army. This has handicapped the work at the Vineland contest very materially.

The extreme shortage of staple feeding stuffs and the inability to obtain them during certain parts of last winter was a very serious problem, making it necessary to curtail many of the feeding research projects. The experimental feeding work has been centered more largely on war emergency problems in an effort to find efficient concentrates which would meet the needs of poultry rations at a moderate cost. One very valuable factor learned during the last year's work is the possibility of greatly increasing the amount of mash fed to laying hens and growing stock, and greatly reducing the amount of grain fed. Such practice results in a great reduction in the cost of the ration and more efficiency in production and growth.

New Jersey, among the other eastern states, has been hard hit in its poultry industry, because of the great distance over which feed and fuel must be transported, as well as the scarcity and high prices of these commodities. In order to help meet this emergency, the poultry husbandman of the Experiment Station has personally devoted considerable time and energy to meet these problems through cooperative and organization methods. The correspondence of the department, much of which has been of an emergency nature, has increased during the year.

Practically all of the breeding work which has been under way for the past few years has been maintained, though somewhat reduced in volume. The work at the Vineland contest has progressed in an exceptionally gratifying manner. The two-year-old hens during the current year have succeeded in laying a production nearly equal to their pullet performance. Excellent results have been attained in the hatching and rearing of the young stock from the contest birds, and a very promising year of the contest is anticipated. The contest has brought out many valuable research results, from a breeding as well as from a feeding standpoint.

The policy of the poultry department in meeting the war emergency is two-fold: first, to keep thoroughly informed of existing conditions in the state by studying through every possible means the condition of every changing factor affecting the industry and to determine the reaction of such conditions upon production; and, second, to attempt to stimulate in every possible way a greater efficiency in poultry production and to strive in so far as is consistent with cost and revenue factors, to maintain production. With the aim of meeting this program, definite suggestions and teachings have been promulgated and given wide publicity through personal contact with organizations, through demonstration projects, and through individual visits, as well as through the agricultural and poultry press and through our regular "Hints to Poultrymen."

The aims and purposes in administering the forces of the poultry department are and will be to help win the war by uniting the poultry interests of the state; by fostering the industry through proper counsel and advice, and through the closest attention to these efforts to support the nation in the production of an adequate supply of poultry and eggs.

DAIRY HUSBANDRY

The following five principal lines of endeavor have been pursued by the department of dairy husbandry during the eight months ending June 30, 1918.

Experimental

The experimental work has consisted principally of the long-time experiment on the conformation of dairy heifers as indicating their future production. This experiment has been running for two years. A new experiment, The Milking Machine and Its Relation to Sanitary Milk Production, has been started during the past year.

Extension Work

The dairy extension work has been exceptionally heavy during the past year. Advice and assistance to the dairymen of the state have been given through cooperative dairy projects, correspondence, personal visits and institutes.

One new dairy record association has been formed, making in all nine active dairy record associations.

The formation of the State Dairymen's Association has been completed.

Advanced Registry Work

There has been a slight increase in the number of cows on advanced registry. From this it is evident that the breeders, even under the adverse conditions of feed and labor, have confidence in the future of the dairy cattle industry.

Glassware and Testers' License Law

The supervision of the creameries and milk plants in the state with reference to their testing of milk and cream where milk and cream are purchased on the butterfat basis has been carried on in a similar manner as in the previous year. A total of 1,985 pieces of glassware were tested with an average proportion of inaccuracy of 3.8 per cent. This shows that the law is having its effect in bringing a better grade of glassware into the state.

The Dairy Herd and Equipment

The dairy herd has seen a substantial increase to June 30, 1918, totalling 102 animals. The total at the end of the last fiscal year was 74, showing an increase of 28 animals.

A new addition to the barn has been almost completed. This work has been very much hindered because of inability to get materials, but undoubtedly the barn will be ready for the stabling of cattle by cold weather.

SEED CONTROL

The unusual conditions of the country's seed supply, the demand for crop production and a growing appreciation of the importance of good seeds in relation thereto, have had a marked effect on the extent of service demanded from the seed laboratory. Fortunately, conditions enabled this department to meet the demand and much has apparently been gained in establishing the necessity of maintaining the seed laboratory.

In particular, it was possible to perform a very beneficial service to the corn growers of the state, who faced the 1918 season with a very uncertain supply of seed. Testing many samples for farmers, issuing instructions for home testing and emphasizing the need of most careful discrimination in selecting seed corn saved many thousands of dollars to the state.

The official inspection of dealers' stock has been seriously limited by lack of funds. This is a most important phase of the work and, if neglected, the object of the law will be altogether nullified. For this work there is most urgent need of a man who can be in the field all the time if necessary, maintaining contact with dealers throughout the state and sampling dealers' stock freely. In this way only can the seed laboratory approach the desired condition of assuring accuracy of label statements to purchasers. The laboratory is organized and equipped, and to do its utmost there must be sufficient appropriation to extend the work as indicated.

AGRONOMY

The agronomy department has continued the work of the preceding year, some of which has been finished and has been placed in manuscript form for publication. The study of the source of alfalfa seed, the time of seeding alfalfa and the methods of raising alfalfa, together with that of sweet clover, is much the same as in the preceding year. Because of lack assistance and shortage of funds, the work on varieties of grains had to be discontinued at this time.

Farm management on poultry farms and the cost of egg production was studied during the past year in cooperation with the poultry department. The study has brought to light some very pertinent information on this important industry which has suffered so severely because of war conditions.

The study of the cost of milk production and the organization of dairy farms was also made and completed during the past year, so that the Station was enabled to produce real evidence when the investigations were made on the cost of milk production for the New York and Philadelphia markets. This evidence was presented to the New York Dairy Committee, appointed to investigate the cost of milk production, the Federal Milk Commission for the New York market, as well as the Commission of the City of New York alone, which investigated the cost of milk production.

Much time has been given to emergency work concerning such problems as affect the farm most vitally.

Farm labor has received considerable attention through this department. Much time has been devoted to the distribution and use of good alfalfa seed, while the improvement of corn throughout the state has been given considerable attention through the extension division and through the State Corn Show, which was under the direction of the agronomy department.

The marketing and grading of alfalfa also has been taken up by the department, so that we can now assure the farmers who wish to grow this crop that there is a good and definite market waiting for their product.

AGRICULTURAL EXTENSION

Emergency war work has interfered seriously with the regular educational work of specialists and county farm demonstrators. Only one thing really counts today, and that is the winning of the war. The members of our staff have neglected their educational projects only so far as immediate necessities required. The policy has been to maintain the leading ones, but the urgent calls of the national government for service have not been neglected.

The reports of leaders in county farm demonstration, home demonstration, boys' and girls' club work and the reports of the specialists are submitted with a considerable degree of pride. The thorough organization of county farm demonstration is due largely to Mr. John H. Hankinson, who resigned from the state leadership May 1, 1918. Our thanks are due to Prof. Frank App, head of the department of agronomy in the Station and College, who most kindly became acting state leader and served most efficiently until the close of the fiscal year.

The home demonstration work has been well organized by its state leader, and is especially serviceable under present war conditions.

The state club work has been put upon an especially satisfactory basis by its state leader.

Our farm demonstration work, manned by a staff of earnest, efficient men, owes much to the specialists connected with the central office.

Probably the outstanding fact in the eight months' experience is the development of community interest and team work in our various counties, with the assistance of capable farm demonstrators, that is helping in a practical way to win the war. The extension staff has worked as a unit in a most gratifying degree.

SOIL CHEMISTRY AND BACTERIOLOGY

The report for this year is short, since the date for the ending of the fiscal year has been changed from October 31 to June 30.

Field Plots

This work has been continued as outlined in previous reports and bulletins. This year being the first of the third 5-year period, the majority of the plots are in corn. The land was plowed and prepared early and the corn planted about the middle of May. With the exception of considerable cool weather, the season has been favorable and the corn is now in excellent condition.

The scarcity of potash, together with the fact that these plots have had generous applications of this material for the past ten years, led to the decision to omit the potash from most of the plots this year. It is believed that such omission will not in any way interfere with these experiments. Other fertilizers were applied in accordance with the plans.

The work with different varieties of soybeans on lime and unlimed plots is being continued. At this writing all varieties on limed plots are much superior, both as to size and color, to corresponding varieties on unlimed plots. Samples of soil have been collected from most of the plots for future analysis.

Cylinder Experiments

The experiments on the availability of nitrogen in different nitrogenous materials and the accumulation and utilization of nitrogen by means of leguminous crops are being continued.

This season begins the fifth 5-year period for the loam soil cylinders where nitrogen availability studies are being carried on. These cylinders are now in corn and this is in excellent condition, except where the fertilizer treatment has been adverse. A partial summary of the results from these cylinders for the first twenty years has been published.

Potash Availability

The work on the availability of potash in greensand marl is being continued by means of pot experiments. The plan calls for the growing of certain crops such as soybeans and buckwheat which may be able to utilize slowly-available potash, these crops to be used in turn as manure crops to supply potash for such crops as require a more available supply of potash.

Soil Fungi and Bacteria

On account of the withdrawal of Messrs. J. R. Neller and R. E. Curtis for other service, little work was done on these projects during the period covered by this report. After the first of July the work will be carried on by Dr. S. A. Waksman, who was formerly connected with this department.

Potato Fertilizer Equipment

The cooperative fertilizer experiment with potatoes at Elmer has been continued. The work this year is practically a duplication of last year's work. The plan allows for a study of the residual effect of the marl which was used last year. There are very strong indications that there is a close relationship between the fertilizers used and the early dying of the tops. It is hoped that the problem can be further studied next year.

BOTANY

The projects carried on in this department may be briefly described as follows:

Inheritance of Hybrid Characters. Subjects in hand are (1) the bean hybrid between "Scarlet Runner" and "Refugee Wax"; and (2) the egg-plant hybrid, a union of "Dwarf Purple" and "Scarlet Chinese." Two hundred plants of the former and fifty of the latter are now growing for study and comparison.

Inheritance of Prolificness. Selections of prolific and non-prolific plants are made according to yield. No definite results have been obtained as yet.

The Fixation of New Types. Desirable strains often result in breeding work.

Size of Seed as Related to Position in the Pod. The plants of this experiment are beans, peas, peanuts, soybeans and grains.

Depth of Planting as Related to Viability, Vigor and Yield. Beans, corn and soybeans come under this heading. The planting depths for beans are 1, 2 and 3 inches; for corn, 1, 2, 3, 5 and 7 inches.

Plant Physiology. During the year particular attention has been given to the following lines of work: A study (1) of the salt requirements of plants at different stages of their development, in sand and in solution cultures, (2) of the relation of moisture content of various types of soil and sand to the proportions of the fertilizer constituents as these affect the growth of plants, and (3) of the influence of moisture content of the substrata upon the toxicity of certain inorganic salts toward plants.

ENTOMOLOGY

In this period of eight months the entomologist and his assistants have handled 4000 letters, and inquiries concerning 82 species of insects have been received and answered.

For the first time it has been determined that summer-strength commercial lime-sulfur (1 gallon to 40 gallons of water) may be used to hold the pear psylla in check.

Satisfactory control of the plum curculio on apple has been obtained through maintaining a coating of summer-strength commercial lime-sulfur (1 gallon to 40 gallons of water) and arsenate of lead (2 pounds to 50 gallons) on fruit and foliage from the fall of blossoms until a period of three weeks has passed. To maintain this coating the ordinary spraying schedule must be modified by substituting for the spray recommended ten days after the blossoms drop a treatment one week or less after the blossoms fall and another treatment ten days later.

It has been determined that the sprinkling sewage filter fly, a small insect of considerable economic importance and always found in connection with sprinkling sewage filters, may be destroyed by submerging the filter for a period of 24 hours with the ordinary sewage.

A cooperative study of the biology of a sprinkling sewage filter has been organized and money provided therefor. The cooperators are the New Jersey State Board of Health, the New Jersey Agricultural Experiment Station and the Joint Sewer Commission of the City of Plainfield and the boroughs of North Plainfield and Dunellen.

An organization has been created and is now carrying forward, under a plan made in conference by the growers and the director and entomologist of the Station, investigations of the plant-food problems, soil acidity problems, soil moisture problems and insect problems of cranberry culture.

It has been determined that 98 to 100 per cent of aphid eggs, which are well coated with a mixture composed of commercial lime-sulfur, 1 gallon in eight or nine gallons of water to which 40 per cent. nicotine has been added at the rate of 1 to 500, are destroyed provided the application is made just before the leaves project from the opening apple flower buds like tiny squirrel ears.

It has been determined that 1½ to 2 per cent. of crude carbolic acid to which fish-oil soap is added at the rate of 1 pound to 6 gallons of water gives considerable promise as an agent for destroying apple aphis eggs when applied at the time above mentioned. It has also been shown that when 40 per cent. nicotine (1 to 500) is substituted for the crude carbolic acid the same result follows.

It has been shown that card protectors placed on peach trees in late June and kept thoroughly sealed throughout the season, to October first prevent all or practically all of the trees from being infested with worms arising from eggs laid during that season.

A contract for cutting 275,862 linear feet of ditching in the salt marshes of Ocean and Cape May counties has been let to the United States Drainage and Irrigation Company for the sum of $9600.

Hudson, Bergen, Passaic, Morris, Essex, Union, Middlesex, Monmouth, Ocean, Atlantic and Cape May counties are working on the control of mosquitoes during the present season. Hudson, Bergen, Essex, Union and Atlantic counties are attacking the problem of controlling all species that breed within their limits. Passaic County is attacking the problem of controlling all species that breed in the southern half of the county. Middlesex, Monmouth, Ocean and Cape May counties are devoting practically their entire attention to the salt-marsh mosquito problem. Morris County is making a survey of the mosquito-breeding places within its limits with the view to the formulation of plans for attacking the problem as a whole.

Plans for mosquito control at the Raritan Ordnance Depot at Bonhamtown, N. J.; at the New York Shipbuilding Corporation, Camden; at the New Jersey and Pennsylvania Shipbuilding Companies in Gloucester; at the Atlantic Loading Company in Ellwood, and the Bethlehem Steel Testing Plant at Mays Landing, have been prepared and submitted to the organizations in question. The work is now going forward at the Raritan Ordnance Depot and at the Camden and Gloucester Shipbuilding plants.

Plans for mosquito elimination in the Frank Creek section of the Kearney marshes west of Frank Creek have been prepared and submitted to the Hudson County Mosquito Extermination Commission.

Plans for the installation of a 3-flume tide-gate at the mouth of Saw Mill Creek are being prepared and the money involved has been raised.

At the request of the chief of sanitation and health of the Emergency Fleet Corporation, plans for the control of mosquitoes at the International Shipbuilding Corporation plant, located on Hog Island, for the Westinghouse electric plant, located at Essington, and various housing propositions connected therewith, and plans for the control of mosquitoes at the three shipbuilding yards in Wilmington, North Carolina, have been prepared. Work is now going forward at these points.

An investigation has been made and plans for mosquito control for the area beginning at Penns Grove and extending northward to Camden and Gloucester have been prepared.

All told, these plans are made to provide protection for approximately 177,000 people at a cost of a little less than half a million dollars.

Projects involving the expenditure of $263,000 are now going forward, and the employees and persons living adjacent to the International Shipbuilding Corporation, the Westinghouse Electric Company, the Wilmington Shipyards, the New York Shipbuilding Corporation, the New Jersey Shipbuilding Company, the Pennsylvania Shipbuilding Company and a Bag Loading Plant below Gloucester either are already or soon will be afforded a reasonable degree of protection from the mosquito pest.

PLANT PATHOLOGY

Mr. C. M. Haenseler, Mr. R. F. Poole, Mr. F. P. Schlatter and Dr. W. H. Martin are in the United States Military Service. Mr. C. A. Schwarze resigned as assistant nursery inspector June 1, 1918. Dr. L. M. Massey, of the United States Department of Agriculture, has been assigned to New Jersey for extension work in plant pathology and is stationed at New Brunswick. Mr. Erdman West, of Pennsylvania State College, has been employed as assistant nursery inspector.

The research work has been greatly reduced because of war conditions, but studies are being continued on tomatoes and potatoes and on other diseases wherever possible.

It is very important that special studies be made on seed-bed diseases and upon the diseases of truck crops, and also upon the influence of disease on perishable products in shipment.

There should be another worker in the department giving the greater part of his time to the study of resistant strains of plants. There should be another worker devoting practically all of his time to the study of the diseases of potatoes, especially those that are transmitted in the seed. Studies should also be continued on celery and other truck crops.

It is very important that something should be done to put the herbarium in condition for work to the best advantage.

The plant disease survey of the United States Bureau of Plant Industry, carried on in cooperation with the various states, is proving very helpful and there should be more thorough survey of the diseases of New Jersey.

PUBLICATIONS

The office of the editor has been concerned during the fiscal year with the following main lines of activity: (1) the revision of the mailing list, (2) the editing and publishing of the regular Experiment Station and extension publications, (3) special publications, (4) special publicity work and (5) plans for the improvement and expansion of the publications and publicity work.

The revision of the mailing list has involved much time and effort. Several thousand "dead" addresses have been dropped from the old list; names of persons on the old list who still desire our publications have been retained and new addresses have been added through the use of the mailing lists of the State Department of Agriculture, the county boards of agriculture and the poultry associations. The work of revision is still in progress at this writing. The list has been carefully classified, and through the use of a new addressograph machine equipped with a selective device, which was installed during the year, a great saving is being accomplished in our publications as well as better service to persons receiving them. It is planned to increase the efficiency of the mailing service still further by the use of a graphotype machine, making it possible for us to make our address plates in our own office, as soon as funds will permit.

The following regular publications have been issued during the year, and have been or will soon be sent to the mailing list:

Bulletins

No.
315 Analysis of Materials Sold as Insecticides and Fungicides for 1917.
316 The Influence of Lime upon the Yield of Dry Matter and Nitrogen Content of Alfalfa.
317 Report of the Director for the Year Ending October 3, 1917.
318 Analyses of Commercial Fertilizers and Ground Bone: Analyses of Agricultural Lime.
319 A Study of Physiological Balance for Buckwheat Grown in Three-Salt Solutions.
320 Farm Profits and Factors Influencing Farm Profits on 460 Dairy Farms in Sussex County, N. J.
321 Fertilizer Registrations for 1918.
322 Results of Seed Inspection, 1917.
323 The Value of Nitrate of Soda in Crop Production.
324 The Strawberry Weevil.
325 Poultry Buildings: Laying and Breeding Houses.
327 Commercial Feeding Stuffs and Registrations for 1918.
328 Some Important Orchard Plant Lice.

Circulars

No.
88 Common Diseases of Berries.
89 Common Diseases of Garden Vegetables and Truck Crops.
90 The Feeding and Management of Swine.
91 The Bean Weevils.
92 The Angoumois Grain Moth
93 Spray Calendar for Apples and Quinces.
94 Spray Calendar for the Peach.
95 Seed and Soil Treatment for the Control of Potato Scab.
96 Leaf Blight of the Tomato.
97 Common Diseases of Ornamental Plants.
76 Spray Calendar for Pears. (Reprint.)
77 Spray Calendar for Sweet Cherry. (Reprint.)
78 Spray Calendar for Plum. (Reprint.)

Reports

1917. Thirty-Eighth Annual Report of the New Jersey State Agricultural Experiment Station, and Thirtieth Annual Report of the New Jersey Agricultural College Experiment Station.

Hints to Poultrymen. Monthly, Vol. 6, No. 2-9.

Publications of the Division of Extension

Extension Bulletin

Vol. 1, No. 14. Proper Care and Use of Farm Manure.
No. 15. Home Canning and Curing of Meats.
No. 16. Boys' and Girls' Club Work in New Jersey.
No. 17. Breads: Good Breads that will save Wheat.
No. 18. Farm Labor.

The Farm Demonstration Exchange (monthly), Vol. IV, No. 1-5.
The Weekly News Letter, vol. 5, no. 1-35.
Poster Bulletin 1, "Prevent Waste of Farm Manure."

Also, the editor has assisted in the preparation of the monthly news letters of the county offices of farm demonstration.

Beginning with January, 1918, provision was made for the editor's office to handle the editorship of the "Voorhees Farmer," a monthly agricultural journal established by the E. B. Voorhees Agricultural Society in 1917. The members of the Experiment Station staff have given valuable cooperation in conducting this journal. The station editor has continued his work with "Soil Science," which is published by the Waverly Press, of Baltimore, Md. This journal has furnished a useful medium for the publication of many research articles prepared at the Experiment Station, and has thus effected a saving of station funds which would have otherwise been used in printing the papers as station publications. The "Experiment Station News" has been continued as a medium for local Experiment Station publicity of interest to the staff members, and for the local newspapers.

A limited amount of special publicity work has been done for the Experiment Station. Special articles have been written for the daily papers of New Jersey, and distributed through one of the news agencies of the state.

The editor has been greatly assisted by the cooperation of the Publicity Committee of the Experiment Station Council. The committee made a study of the present publicity system and its needs, and outlined a policy which was adopted by the Experiment Station Council. Several of the recommendations have already been put into effect, and it is planned to follow out the whole program as soon as conditions permit. A summary of the recommendations follows: (1) Brevity, clearness of expression and emphasis of the practical aspects of recommendations in popular bulletins and circulars, (2) the more extensive use of suitable illustrations in popular publications, (3) the publication of condensed, one-page extension circulars or cards, (4) the enlargement of the mailing list, (5) the publication of a well-illustrated circular describing in a popular way, the work of the Experiment Station, (6) the use of a slip bearing summarized information concerning the Experiment Station, to be enclosed with correspondence, (7) a publicity service to the newspapers of the state and other agencies, consisting of special multigraphed letters, (8) the establishment of a clipping service, (9) the preparation of cardboard posters telling how the Experiment Station may be of assistance to the farmer, to be distributed about the state, (10) the installation of a multigraph machine, and (11) provision in the budget for more finances to support publicity work.

This report indicates the needs of the editor's office and shows the lines of work along which effort is being made. Throughout the year special attention has been given to the emergency conditions arising from the war, and a large proportion of the work has been directly concerned with problems of increasing food production as related to war needs.

Technical Papers

Experiments with Sulfur-Phosphate Composts Conducted under Field Conditions. J. G. Lipman and H. C. McLean. *Soil Science*, vol. 5, p. 243 (1918).

Twenty Years' Work on the Availability of Nitrogen in Nitrate of Soda, Ammonium Sulfate, Dried Blood and Farm Manures. J. G. Lipman and A. W. Blair. *Soil Science*, vol. 5, p. 291 (1918).

Abortiveness as Related to Position in the Legume. Byron D. Halsted. *Proceedings of the Thirty-sixth Annual Meeting, Society for the Promotion of Agricultural Science*, November, 1917.

Color in Vegetable Fruits. Byron D. Halsted. *Journal of Heredity*, vol. 9, p. 18, January, 1918.

Reciprocal Breeding in Tomatoes. Byron D. Halsted. *Journal of Heredity*, vol. 9, p. 169, April, 1918.

Toxicity of Monobasic Phosphates Towards Soybeans Grown in Soil and Solution Cultures. J. W. Shive. *Soil Science*, vol. 5, no. 2, p. 87-122 (1918).

A comparison of Salt Requirements for Young and for Mature Buckwheat plants in Water Cultures and Sand Cultures. J. W. Shive and W. H. Martin. *American Journal of Botany*, vol. 5, no. 4, p. 186?191 (1918).

Effects of Ammonium Sulfate in Nutrient Solutions on the Growth of Soybeans in Sand Cultures. M. I. Wolkoff. *Soil Science*, vol. 5, no. 2, p. 123-150 (1918).

The Oxidation of Sulfur by Microorganisms in its Relation to the Availability of Phosphates. H. C. McLean. *Soil Science*, vol. 4, no. 4, p. 337 (1917).

Studies on the Correlation between the Production of Carbon Dioxide and the Accumulation of Ammonia by Soil. J. R. Neller. *Soil Science*, vol. 5, no. 3, p. 225 (1918).

Some Availability Studies with Ammonium Phosphate and its Chemical-Biological Effects upon the Soil. F. E. Allison, *Soil Science*, vol. 5, no. 1, p. 1 (1918).

The Mosquito Question: Migration as a Factor in Control. Thomas J. Headlee. *Scientific American Supplement*, vol. 85, no. 2205, p. 214, April 6, 1918.

Effective Methods of Fly Control: A Review of the Factors that Underlie the Problem. T. J. Headlee, *Scientific American Supplement*, vol. 85, no. 2201, p. 150, March 9, 1918.

The Problem of Mosquito Control. T. J. Headlee, *Proceedings of the Entomological Society of Ontario*, January, 1918.

Studies on the Morphology and Susceptibility of the Eggs of *Aphis avenae* Fab., *Aphis pomi* DeGeer and *Aphis sorbi* Kalt. Alvah Peterson. *Journal of Economic Entomology*, vol. 10, p. 556-560 (1917).

Some Experiments on the Adults and Eggs of the Peach Tree Borer, *Sanninoidea exitiosa* Say and Other Notes. Alvah Peterson. *Journal of Economic Entomology*, vol: 11, p. 46-55 (1918).

The Rectal Tracheæ and Rectal Respiration in *Mecistogaster Modestus* (*Odonata*). Mitchel Carroll. *Proceedings of the Philadelphia Academy of Natural Science for* 1918.

Popular Papers

Our Fertility Resources as Bearing on the Present Emergency. J. G. Lipman. *N. J. State Department of Agriculture* Bulletin 11, January, 1918.

Soil Bacteria as a Factor in Soil Fertility. J. G. Lipman, *Philadelphia Society for Promoting Agriculture, Bethayres, Pa.*, March, 1918.

Articles on Organic Matter, Lime and Fertilizers. Alva Agee. *The Farmer's Own Encyclopedia.*

How Shall New Jersey Peaches be Graded and Marked? M. A. Blake. *Proceedings of the New Jersey State Horticultural Society*, 1917.

The Fruit Exhibit at the Trenton Fair. M. A. Blake. *Voorhees Farmer*, November, 1917.

Observations upon Summer Pruning of the Apple and Peach. M. A. Blake. *Proceedings of American Society for Horticultural Science*, 1917.

Important Points in Apple Spraying. M. A. Blake. *Voorhees Farmer*, May, 1918.

Suggestions to Fruit Growers. M. A. Blake. *Voorhees Farmer*, March, 1918.

Fine Apple Crop in Demonstration Orchards. M. A. Blake. *Voorhees Farmer*, July, 1918.

Apples and Peaches Ripening Early. M. A. Blake. *Voorhees Farmer*, July, 1918.

Experiments on Making Peach Syrup and Marmalade. M. A. Blake. *Voorhees Farmer*, July, 1918.

Paper Pots and Dirt Bands. L. G. Schermerhorn. *Rural New Yorker*, March 2, 1918.

Notes on New Varieties of Strawberries. A. J. Farley. *Voorhees Farmer*, June, 1918.

In the Interests of Fair Play. John P. Helyar. *Seed World*, July, 1918.

Make it Buckwheat. Frank App. *Voorhees Farmer*, May, 1918.

Alfalfa in New Jersey Gets Big Boost. Frank App. *Voorhees Farmer*, February, 1918.

Corn Show a Big Success. Frank App. *Voorhees Farmer*, February, 1918.

What About Next Year's Farm Labor? Frank App. *Voorhees Farmer*, January, 1918.

New Jersey's 1918 Corn Crop. Frank App. *Voorhees Farmer*, April, 1918.

Caring for the Crops. Frank App. *Voorhees Farmer*, June, 1918.

Alfalfa Association Making Progress. Frank App. *Voorhees Farmer*, March, 1918.

Home Preservation of Eggs. R. R. Hannas. *Rural New Yorker*, April April 6, 1918.

Quality in Market Eggs. R. R. Hannas. *Country Gentlemen*, April 27, 1918.

Care of Growing Chicks. R. R. Hannas. *Pennsylvania Farmer*, June 1, 1918.

The Relationship of the Manufacturer to the State Official. C. S. Cathcart, *Feeding Stuffs Trade Paper*, July 1918.

Fertilizers Essential for Big Crops. A. W. Blair. *Hoard's Dairyman*, February 15, 1918.

An Experiment in Pig Feeding. J. M. Hunter. *Rural New Yorker*, July, 1918.

Feeding Soft Corn to Hogs. J. M. Hunter. *Voorhees Farmer*, November, 1917.

Hogs and The World War. J. H. Hunter. *Voorhees Farmer*, December, 1917.

The Winter Care of Farm Horses. J. M. Hunter. *Voorhees Farmer*, January, 1918.

Replies to What the Farmers are Asking. J. M. Hunter. *Voorhees Farmer*, February, 1918.

Replies to What the Farmers are Asking. J. M. Hunter. *Voorhees Farmer*, March, 1918.

Replies to What the Farmers are Asking. J. M. Hunter. *Voorhees Farmer*, April, 1918.

The Swine Industry in New Jersey. J. M. Hunter. *Voorhees Farmer*, May, 1918.

Use Wheat Substitutes for Pigs. J. M. Hunter. *Voorhees Farmer*, July, 1918.

Dairying in Winter. J. W. Bartlett. *Pennsylvania Farmer*, January, 1918.

Calf Club Work in New Jersey. J. W. Bartlett. *Kimball's Dairy Farmer*, July 15, 1918.

The New Jersey State Dairymen's Association. J. W. Bartlett. *Hoard's Dairyman*, June 12, 1918.

Control of Orchard Plant Lice. T. J. Headlee. *Pennsylvania Farmer*, March, 1918.

Staff Changes

A list of changes in the station staff during the past eight months is given herewith:

Appointments

C. S. Lamson	Research Assistant
Isabel V. Delaney	Telephone Operator
William Whynman	Poultry Assistant
Cyrus Witmer	Assistant, Soils Department
A. Sydney Carroll	Teamster
Ernest O. Winkler	Helper
Hazel H. Moran	Assistant Librarian
Frank G. Helyar	Associate in Station Administrat'n
Maurice Fincken	Orchard Foreman
Nils B. Swenson	Helper
Helen L. Goodwin	Statistician
Sarah E. Van Middlesworth	Office Assistant
M. E. Stone	Helper

C. S. Clarkson	Assistant Chemist
W. B. J. Reitze	Contest Foreman
Noyes S. Purrington	Fertilizer Sampler
Mitchell Carroll	First Assistant in Entomology
Cyrus H. Harrison	Helper
Clifford Strohmeyer	Helper
William J. Stoneback	Assistant Chemist
Russell H. Sears	Orchard Assistant
Irving L. Owen	Associate Agronomist & Farm Mgr.
Fred Boorman	Helper
Robert H. Cole	Assistant Chemist
Louis Schwartz	Assistant Chemist
Fred C. Corwin	Helper
F. A. Hall	Helper
P. C. Cameron	Temporary Assistant Biologist
E. B. Bleeker	Field Assistant
Fred Freund	Helper
Charles M. Mulhollan	Helper

The following also were employed in a temporary capacity: George W. Woods, James McPherson, Felix Ramsey, Zelik Schutzbank, Frederick C. Bruer, Richard Goines, Harold Barbour, Isaac Reis, Cornelius A. Perry, Svenn A. Rusch, Harry M. Allen, Frank Welchman, Louis Zimmerman, Walter R. Robbers, Dudley Cobb, Charles H. Cane, Benjamin Masurovsky, Eugene W. Bates and Joseph Fox.

Resignations

Joseph R. Neller	Research Assistant
Robert F. Poole	Research Assistant
Charles S. Lamson	Research Assistant
William H. Martin	Research Assistant
Russell E. Long	Office Assistant
Edward W. Harvey	Research Assistant
Hubert F. Brennan	Night Watchman
Merrill G. Clayton	Helper
W. Raymond Stone	Orchard Foreman
D. James Kay	Assistant Chemist
Paul S. Race	Helper
James G. Rugh	Contest Foreman
Allen G. Waller	Assistant Extension Specialist in Agronomy
Marie A. Klein	Statistician
Joseph Schmidt	Helper
George T. Reid	County Supt. of Farm Demonstration for Burlington County
C. S. Clarkson	Assistant Chemist
R. L. Scharring-Hausen	Field Assistant
Joseph Kovanda	Helper
William B. J. Reitze	Contest Foreman
Melvin Cosh	Helper
John H. Hankinson	State Leader of Farm Demonstration
Robert Poultney	Assistant Extension Specialist in Dairy Husbandry
Charles S. Van Nuis	Associate Agronomist and Farm Manager
Willard C. Thompson	Assistant Poultry Husbandman
William Whynman	Poultry Assistant

The following members of the staff have resigned to enter the military service of the country: Louis K. Wilkins, Herman J. Levine, David Schmidt, Orville C. Schultz, Conrad M. Haenseler, Thurlow Nelson, John Monteith, Jr., Lawrence G. Gillam, Howard F. Huber, Julian F. Miller, Fidel P. Schlatter, Richard Goines, William H. McCallum, George M. Dunn, Carl Egerton, J. Manderson Evans, Robert F. Poole, Joseph R. Neller, William H. Martin, Russell E. Long, Allen G. Waller, Robert P. Marsh, Charles S. Lamson, Willard C. Thompson, William Whynman, George W. Martin, David A. Coleman, Carl R. Fellers, Joseph Schmidt, W. J. Stoneback, A. P. Muller, Robert E. Welsh, Robert I. Clark, Harry M. Allen, J. H. Dumm, Leslie Morrow, L. W. Hill, Robert Poultney, A. H. Sanford, William H. Nulton and Albert Smith.

REPORT OF THE DEPARTMENT OF CHEMISTRY

Department of Chemistry

CHARLES S. CATHCART, M.SC., *Chemist.*

*C. S. CLARKSON, B.SC., *Assistant Chemist.*

RALPH L. WILLIS, B.SC., *Assistant Chemist.*

†W. J. STONEBACK, B.SC., *Assistant Chemist.*

ARCHIE C. WARK, *Laboratory Assistant.*

W. ANDREW CRAY, *Sampler and Assistant.*

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* Resigned March 1, 1918.
† Appointed March 1, 1918, Resigned June 1, 1918.

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FEB -3 1920

Report of the Department of Chemistry

Charles S. Cathcart

The activities of the Department of Chemistry are largely confined to the inspection of the materials sold as feeding stuffs, fertilizers, agricultural lime and insecticides. Since it is impracticable to make all of these inspections continuously during the year it is necessary to prescribe the time for making each inspection. In accordance with this necessity the following schedule has been used for several years:

Inspection of Commercial Feeding Stuffs—November to March.

Inspection of Fertilizers, Agricultural Lime and Insecticides—March to November.

The previous annual reports contained the results of all of the inspections required by the several laws, but since this report is for only a part of a fiscal year it is impossible to report in detail the results of all of the inspections. The inspection of commercial feeding stuffs is the only inspection that has been completed since the last report, and the results are given on the following pages. Brief statements are made in regard to the other inspections in order that a record may be made of the condition at the present time.

INSPECTION OF COMMERCIAL FEEDING STUFFS

The law entitled "An Act Concerning Commercial Feeding Stuffs" requires an annual inspection of the materials on sale in this state and the publication of the results obtained. In accordance with these requirements the inspection was made and the results obtained were reported in detail in Bulletin 327.

The Requirements of the Law

The object of the law may be stated in one word—protection, and it applies with equal force to the consumer and to the honest manufacturer. In order to accomplish this desired result the following requirements are given:

1. A statement attached to the material which will certify the name and address of the party responsible for placing the commodity on the market; the minimum content of protein, the minimum con-

tent of fat, the maximum content of crude fiber, and the specific name of each ingredient contained in the feed.

2. The registration annually of the information to be attached to the feed.

3. The inspection of the materials as sold and the publication of the results of the inspection.

It is apparent that all of the above requirements are necessary, but the most important to the consumer is the one relating to the statements required to be attached to the materials as sold. These statements should be closely studied, since the value of a feed for any particular purpose depends not only upon its content of protein, fat and fibre, but also, upon the materials from which these nutrients are derived. It must be remembered, however, that because a material is properly branded it is not necessarily an economical feed, since the law does not prohibit the use of any material that is not injurious, nor does it regulate the proportionate amounts of the various ingredients used.

Registrations

The law requires an annual registration of the feeding stuffs that will be offered for sale, and in accordance with this requirement 469 manufacturers and jobbers registered 2553 brands.

During the regular inspection 39 brands were located which had not been registered, and the parties having the materials were notified of the requirement necessary to be attended to before sales could be legally made. Registrations were received for most of these brands within a short time. This condition was an improvement over that reported for the preceding inspection, and it is evident that, as a rule, the manufacturers are attending to this question at the proper time. The chief offenders are the local manufacturers, but whether it is from a lack of knowledge as to the requirement or for any other reason, it is a question that should be carefully considered so that the registrations are made at the proper time.

On account of the present conditions of the trade, several requests have been received to re-register brands with a lower guarantee than had been previously registered. In many cases these requests have been caused by a federal regulation regarding the use of certain feed materials or on account of the scarcity of certain materials that had been previously used in the formula. We appreciate the condition and we will co-operate in every manner possible, but since the law distinctly states "a brand name once registered shall not be changed to a lower grade at any subsequent registration," we have no authority to accept a registration if it is a lowering of the standard. When such changes are necessary the brand name can be changed in some way or a new brand name can be given. The adoption of either of these methods will secure the object of the manufacturer and also, will meet the requirement of the state law.

Tonnage of Feeding Stuffs Sold

Manufacturers and those responsible for feeding stuffs sold in this state are required to render, on July 1, and January 1 of each year, reports showing the total tonnage sold during the six months preceding these dates. Table 1 is a summary of the reports received during the past five years.

Table 1

Summary of Tonnage Reports

Year	July Reports	January Reports	Total for the Year
1913.	93,664.17	102,560.00	196,224.17
1914,	88,192.50	114,508.73	202,701.23
1915,	103,626.91	124,563.34	228,190.25
1916,	111,910.84	123,437.16	235,348.00
1917,	114,939.37	119,101.06	234,040.43

Reports have been issued by other departments which show a large decrease in the live stock in this state, but according to the figures tabulated, the sales for the year of 1917 were nearly 99.5 per cent of those reported for 1916, and about 102.5 per cent of those reported for 1915. It is difficult to account for the tonnage sold unless a system of heavier feeding was practiced, or the home-grown feeding stuffs were replaced to a greater extent by the commercial feeds.

Inspection

The inspection during the past year was conducted in the same general manner as during previous years, but many conditions developed which made it the most complicated one in the history of these inspections. The quantity of feeding stuffs in stock at any place was comparatively small, and in many instances there was no stock on hand; consequently, when a shipment was received it was quickly delivered to the various customers. This condition caused the inspector additional work in order to secure the samples. By close application to the work, we feel not only that representative samples were secured but that all of the different brands sold in an appreciable quantity were represented in the collection.

In addition to the difficulty stated, just before the inspection was started one of the inspectors resigned, and as it was impossible to fill the position immediately the itinerary had to be rearranged so that the territory could be covered by one man. In accordance with this arrangement the samples were collected by Mr. W. A. Cray.

During the inspection, 1059 samples were officially collected, and 45 samples were received from individuals. Every county in the state was visited and the samples were received from 297 dealers and consumers, whose addresses include the names of 160 towns and cities.

Examination

Every sample reported was examined by the use of the official methods adopted by the Association of Official Agricultural Chemists in order to determine the content of protein, fat and fiber. The microscopical examinations were not made this year because the member of the staff who had the required experience in this kind of work was called for service in the army. The results of these examinations and the ingredients guaranteed are to be found in Bulletin 327.

Results of the Inspection

The total number of samples examined was 977, and of this number 932 samples were collected by our official inspector in the manner as prescribed in the law. The other 45 samples were submitted by individuals and were reported directly to those requesting the analyses. From the examination of the official samples it was found that 260, or 27.9 per cent, did not substantially satisfy the guarantees given for the content of protein, fat and fiber. The deficiencies found consisted of the following: protein 87, fat 83 and fiber 151; 207 samples being deficient in one nutrient, 45 deficient in two nutrients and 8 deficient in the three nutrients. The above figures show that, taken as a whole, there was an improvement in the character of the feeds sold during the past year when compared with the results reported for the preceding inspection. This is encouraging, but there is still a large percentage of deficiencies to be eliminated before the condition can be considered entirely satisfactory. Table 2 gives a comparison of the deficiencies found in the last five inspections.

Table 2

Statement of Deficiencies

Inspection	Samples examined	Per cent. of samples deficient	Per cent. of samples deficient in		
			Protein	Fat	Fiber
1914, ...	740	17.7	8.2	5.4	7.2
1915, ...	920	17.2	6.7	6.8	6.6
1916, ...	1102	26.6	9.3	9.3	14.0
1917, ...	1103	32.3	10.0	9.3	19.6
1918, ...	932	27.9	9.3	8.9	16.2

A study of the question as to the composition of the animal products such as digester tankage and meat scrap or meat meal was made by the Association of Feed Control Officials of the United States, and as a result of this study it was agreed that if these products contained more than 10 per cent of phosphoric acid, the brand name of the material must contain information showing that bone is present in a larger proportion than is usually found in these products when true to their name. In order to ascertain this information, each sample of the animal products was examined for its content of phosphoric acid and the results are tabulated in Bulletin 327. Six samples were not properly branded since they contained an excess of bone which was not indicated by the brand name.

The Selection of Feeding Stuffs

The value of a feeding stuff depends upon the amount of its nutrients which an animal can, under normal conditions, digest and assimilate for the purpose of building up the growth, repairing the natural waste of the body and producing energy.

Feeds, generally speaking, contain more or less of indigestible matter which does not contribute to the support of the body, and on account of this condition the purchase of a feed that will give the maximum results requires considerable skill on the part of the stock feeder

Concentrated feeding stuffs are generally purchased for the purpose of supplementing the materials raised on the farm, and as such materials usually contain low percentages of protein and fat, the material selected should be governed by its content of these nutrients. In all classes of feed high percentages of protein and fat indicate a high feeding value, while a high percentage of fiber indicates a low feeding value. In such feeds the amounts of protein should determine the price to be paid, other things being equal, and if a selection is to be made between two feeds having the same amount of protein and fat, the one containing the smaller amount of fiber is to be preferred.

If a mixed feed is to be selected, valuable information could be obtained by comparing the analyses of a number of feeds, including the ingredients used in preparing the mixtures. Not much dependence can be placed upon the price of a feed as a guide to its feeding value, since the selling price does not, as a rule, bear any relation to the content of the nutrients present. In accordance with this it is quite evident that the only safe rule to follow is to compare the feeds and their selling prices.

The question of the cost of feeding stuffs has always been one that needed attention, and if this was true in the past years it is certainly true in these times of abnormal prices. Under the present conditions attention to the cost of a material is one of the most important considerations for the consumer, since it may mean either the success or failure of the desired object of purchasing the material. Those who have been purchasing feeding stuffs need not be reminded of the increase in the cost of these materials during the past two years, but it may emphasize the statements made above in regard to this question if the averages of some figures which were collected by our inspectors during the past three years are tabulated. Table 3 gives the average retail selling prices of some of the more important feeding stuffs as they have been obtained and reported during the past three years.

Table 3

A Comparison of the Average Retail Selling Prices

FEEDING STUFF	AVERAGE PER TON DURING THE INSPECTION OF		
	1916	1917	1918
Alfalfa meal,	$31.78	$32.50	$47.00
Brewer's dried grains,	29.25	29.41	52.80
Buckwheat feed,	25.93	39.00	54.00
Buckwheat middlings,	29.00	34.00	51.22
Cocoanut meal,	28.00	33.00	48.00
Corn bran,	27.40	30.10	44.00
Corn feed meal,	33.22	40.33	81.10
Corn gluten feed,	30.11	36.30	59.28
Cottonseed meal,	37.75	46.91	59.00
Distillers' dried grains (corn),	34.50	36.00	63.75
Dried beef pulp,	27.25	37.00	49.25
Hominy feed,	31.73	40.40	65.43
Linseed oil meal,	43.38	44.12	60.07
Malt sprouts,	28.17	32.00	44.50
Meat meal,	57.30	58.00	96.40
Peanut oil meal,	34.50	35.00	59.00
Rye bran,	26.33	29.57	42.80
Rye feed,	32.00	33.00	43.00
Rye middlings,	30.94	35.31	50.68
Wheat bran,	28.16	32.30	45.37
Wheat feed,	28.58	35.00	46.60
Wheat feeding flour,	37.73	41.30	68.00
Wheat middlings,	33.11	38.47	57.12

Table 4 is a summary of the inspection and gives the average composition of the various materials examined with the exception of Calf Meals, Feed Mixtures and Poultry Foods. The averages are not given for these three classes of feeds on account of the variability of the different brands which are reported under their respective headings. In addition to the average composition, the average selling prices and the deficiencies are noted.

In preparing this tabulation the protein as found is considered to satisfy its guarantee if it is not more than 1 per cent. below it. An allowance of 0.5 per cent. is also made for the fat and the fiber determinations

Table 4

Summary of the Results of the Inspection

FEEDING STUFF.	Nnmber of Samples Examined.	Average Composition				Average Retail Selling Price per Ton.	Number of Samples Satisfied Guarantees.	No. of Samples Deficient In					
		Moisture.	Protein.	Fat.	Fiber.			Protein.	Fat.	Fiber.	One Nutrient.	Two Nutrients.	Three Nutrients.
		%	%	%	%	$							
Alfalfa meal,	12	8.05	15.30	1.60	28.20	47.00	10	1	2	1	1	..	1
Brewers' dried grains,	17	7.70	24.83	6.49	14.58	52.80	9	5	2	6	3	5	..
Buckwheat feed,	2	12.96	21.88	5.39	2.89	54.00	1	1	1	..	..	1	..
Buckwheat middlings,	14	13.00	30.64	7.77	4.36	51.22	7	4	2	2	6	1	..
Buckwheat offal,	7	11.03	19.30	5.01	16.10	38.30	4	1	..	3	2	1	..
Calf meal,	8	.....	.....	.....	.....	89.71	3	3	1	4	2	3	..
Cocoanut meal,	3	10.59	20.00	8.14	9.58	48.00	1	2	..	..	2	..	..
Copra cake meal,	2	7.40	20.50	8.61	9.65	50.00	2	..	..	..	..	..	..
Cottonseed feed,	9	7.67	24.12	4.57	20.35	44.60	6	3	1	1	2	..	1
Cottonseed meal,	18	7.58	37.88	6.65	10.54	59.00	12	5	1	..	6	..	..
Corn bran,	2	10.20	9.38	5.99	10.06	44.00	2	..	..	..	..	..	..
Corn feed meal,	8	11.81	9.12	4.76	2.01	81.10	6	..	..	2	2	..	..
Corn gluten feed,	18	8.58	25.53	2.09	6.85	59.28	16	1	1	..	2	..	..
Corn gluten meal,	1	8.56	39.69	0.99	1.18	68.00	1	..	..	..	..	..	..
Corn and cob meal,	14	11.81	7.40	3.51	5.30	56.20	13	..	..	1	1	..	..
Corn and oats,	22	11.25	10.57	4.42	3.47	73.55	19	..	..	3	3	..	..
Distillers' dried grains—corn,	4	7.03	30.92	9.11	11.39	63.75	2	..	1	1	2	..	..
Distillers' dried grains—rye,	1	5.97	18.44	6.98	18.33	.....	1	..	..	..	..	..	..
Distillers' dried grains—yeast,	4	6.95	20.66	6.73	17.12	48.50	1	1	3	..	2	1	..
Dried beef pulp,	5	8.31	9.11	0.66	19.54	49.25	5	..	..	..	..	..	..
Feed mixtures,	275	.....	.....	.....	.....	56.00	194	15	18	64	66	14	1
Fish scrap,	2	6.07	45.41	2.13	(1)	*4.63	....	1	1	..	2	..	..
Hominy feed,	14	8.98	11.26	7.56	4.19	65.43	12	..	1	1	2	..	..
Laxo cake meal,	1	9.97	26.56	7.01	9.86	.....	1	..	..	..	..	..	..
Linseed oil meal,	13	9.39	32.76	6.84	7.88	60.07	10	3	..	..	3	..	..
Malt sprouts	3	7.88	24.33	1.33	12.54	44.50	2	1	..	1	..	1	..
Meat meals,	20	6.99	46.58	14.31	(2)	*4.82	11	9	..	..	9	..	..
Oat feed (largely oat hulls),	3	6.93	3.03	1.18	30.41	31.50	....	3	3	2	..	1	2
Oat hulls, reground,	1	7.26	7.25	2.05	25.06	.....	....	..	1	..	1	..	..
Peanut oil meal,	1	7.40	29.81	12.12	9.11	59.00	....	..	..	1	1	..	..
Poultry bone,	1	6.44	21.88	4.99	(3)	*3.95	....	1	..	..	1	..	..
Poultry foods,	239	.....	.....	.....	.....	79.93	190	22	20	23	36	10	3
Rye bran,	14	11.96	15.53	2.53	4.45	42.80	8	..	1	5	6	..	..
Rye feed,	1	12.32	14.44	2.34	2.83	43.00	1	..	..	..	..	..	..
Rye middlings,	20	12.24	14.04	2.60	3.17	50.68	14	..	1	5	6	..	..
Tankage, digester,	1	6.52	56.75	8.92	(4)	*5.18	....	1	..	..	1	..	..
Wheat bran,	68	10.01	15.11	4.29	9.42	45.37	45	2	15	12	17	6	..
Wheat feeding flour,	6	9.69	17.30	4.98	3.26	68.00	5	..	..	1	1	..	..
Wheat feed,	6	8.95	16.19	4.55	7.61	46.60	6	..	..	..	..	..	..
Wheat middlings,	69	10.69	16.35	4.77	5.16	57.12	49	2	7	12	19	1	..
Wheat and rye middlings,	2	10.60	17.26	4.67	6.23	56.25	2	..	..	..	..	..	..
Wheat middlings and maize red dog flour,	1	7.30	13.50	7.72	3.63	64.00	1	..	..	..	..	..	..

(1) Phosphoric acid 17.51%.
(2) Phosphoric acid 9.92%.
(3) Phosphoric acid 23.62%.
(4) Phosphoric acid 7.57%.

* Average selling price per cwt.

INSPECTION OF COMMERCIAL FERTILIZERS

The collection of the samples of fertilizers representing the spring shipments has been made. The chemical analyses are being looked after by the entire force, but the work has not advanced sufficiently to permit any statements as to the character or composition of the materials sold. The detailed results of the inspection will be published in bulletins as soon as the work has been completed.

Registration

The fertilizer law requires the publication of the registrations and in accordance with this requirement the registrations received between November 1, 1917, and January 28, 1918, were published in Bulletin 321. The registrations received since the latter date will be published later as a part of one of the fertilizer bulletins.

Wholesale Prices of the Essential Elements of Plant Food For 1917

The wholesale prices of the unmixed or raw materials used in preparing the mixed fertilizers are quoted weekly in the trade journal, "The Oil, Paint and Drug Reporter." In order to express the figures given as prices per pound of actual plant-food which is the form adopted by the experiment stations of this country, the quotations have been recalculated and tabulated for the entire year. Since the report of the Experiment Station is made on June 30, the prices that have been tabulated are for the year 1917.

INSPECTION OF AGRICULTURAL LIME

The inspection is being made but has not been completed. The results obtained will be published in bulletin form as usual.

INSPECTION OF INSECTICIDES

The inspectors are now collecting samples of the insecticides which are being offered for sale. The chemical examinations will be made and the results published as usual.

Table 5

Wholesale Cost of Essential Elements of Plant-Food, Per Pound, In New York

MONTHS, 1917	Of Nitrogen in the Form of			Of Phosphoric Acid in the Form of	
	Nitrate of Soda	Sulphate of Ammonia	Dried Blood	Acid Phosphate	
	Min.	Min.	Min.	Min.	Max.
	Cts.	Cts.	Cts.	Cts.	Cts.
January,	20.74	21.95	24.83	4.10	4.25
February,	23.23	23.78	26.56	4.10	4.25
March,	23.93	25.61	27.02	4.10	4.25
April,	23.93	26.34	28.42	4.30	4.40
May,	24.41	26.83	30.24	4.95	5.23
June,	25.85	27.76	34.55	5.20	5.55
July,	26.68	29.66	37.58	5.35	5.70
August,	27.19	31.22	39.77	5.35	5.70
September,	29.16	33.78	39.10	5.60	6.23
October,	30.34	34.59	38.19	6.15	6.85
November,	29.74	33.71	37.95	5.70	6.40
December,	28.94	34.78	39.71	5.70	6.40
Average, 1917,	26.18	29.17	33.66	5.24	
Average, 1916,	20.34	18.46	19.59	4.07	
Average, 1915,	15.47	16.03	17.11	2.70	

REPORT OF THE
DEPARTMENT OF HORTICULTURE

Department of Horticulture

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CHARLES H. CONNORS, B.SC., *Assistant in Experimental Horticulture.*

ARTHUR J. FARLEY, B.SC., *Specialist in Fruit Studies.*

LYMAN G. SCHERMERHORN, B.SC., *Specialist in Vegetable Gardening Studies.*

H. M. BIEKART, *Florist.*

WILLIAM SCHIEFERSTEIN, *Orchard Foreman.*

*ROBERT L. SCHARRING-HAUSEN, B.SC., *Field Assistant.*

VINCENT J. BREAZEALE, *Foreman, Vegetable Growing.*

†MAURICE F. FINCKEN, *Ochard Foreman.*

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* Resigned February 1, 1918.

† Appointed May 1, 1918, Resigned Jan. 31, 1919.

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Report of the Department of Horticulture

M. A. Blake
C. H. Connors

During the period from November, 1917, to July 1, 1918, the department of horticulture has attempted to maintain its important lines of research.

The work in the state experiment peach orchards at Vineland has been continued. In Orchard No. 1, which was planted in the spring of 1907, the fertilizer experiment has been conducted. Since the war had greatly disturbed the plant-food market, it was decided that the results might well be concluded at the end of ten years. This has now become the oldest commercial orchard in its section that is receiving good culture, and it appeared like an exceptional opportunity to treat all portions of it in a way likely to produce the best results, and to demonstrate that a peach orchard can be maintained in profitable bearing condition beyond its tenth year of growth. Accordingly the trees in each alternate row were cut back severely during the dormant season in order to renew the tops. By July 1, a most satisfactory growth had been made by these trees and those not cut back were carrying a full crop.

Orchard No. 2, set in 1908, has a full crop of fruit. No renewal of tops is being attempted in that block.

The pruning experiment in Orchard No. 3 continues to give most interesting and valuable data. The rate of growth of each tree in terms of linear twig development has been measured annually since 1912. The number of peaches produced annually by each tree and their average size also has been noted. It will require a bulletin of good size to publish each season's results in the pruning studies.

The breeding work with carnations has been continued by Mr. Charles H. Connors, and some very promising seedlings will be propagated in considerable numbers when funds permit. No appropriation for supporting the investigational work with flowers was made by the legislature last winter, so it will not be possible to continue the soil and fertility studies at this time. The greenhouses will be devoted to growing of vegetables for the present.

FRUIT CROP CONDITIONS TO JULY 1, 1918

A good crop of strawberries was harvested throughout the state, except where the weevil reduced the number of blooms seriously. The rainfall was sufficient to promote the development of the fruit to an exceptional size. Peaches promise a full crop from Burlington County south, with a medium to good crop along the shore in Monmouth County, and along the Delaware River in Mercer County. Some orchards in Hunterdon will produce some fruit. The crop is a complete failure in Middlesex County, and generally in counties north of it.

Apple trees bloomed freely in all parts of the state, many axillary and terminal flowers developing. Fortunately, a rather heavy drop of set fruit occurred beginning about May 27 at New Brunswick, which thinned the fruits to an average of about one per cluster. The crop should be considerably larger than in 1917 and the quality should be above normal.

Sweet cherries did not set well, although an occasional tree cropped. Sour cherries set well in the southern counties.

Pears bloomed freely, but set a light to medium crop.

Plums are no longer grown in quantities sufficient to consider them commercially. However, the set on individual trees is better than in 1917.

Aphis were not troublesome in early spring, even where trees were not sprayed. Curculio did great damage in some orchards and very little in others. Only the most thorough and efficient spraying will prevent this insect from seriously blemishing apples when it is present in any considerable numbers.

During the latter part of June, pear blight caused considerable injury to such varieties of apples as Fall Pippin, Rhode Island Greening, Twenty-Ounce, Jonathan and Alexander, especially in counties north of Trenton.

WINTER INJURIES TO FRUIT TREES

It was to be expected that a considerable amount of winter injury would develop following the severe winter of 1917-1918 and such was the case. Much of it was of well known types, although there was one form of injury to peaches that was unusual.

Common forms of winter injury to fruit trees include bud killing, twig killing, bark splitting, trunk splitting, collar injury, root killing

The feature of the winter which was most unusual for New Jersey was the fact that there were no warm periods from November to March, so plants remained dormant during the entire time and such injuries as resulted were due to the extreme and continued cold.

The killing of the fruit buds on such plants as the peach may occur with little or no killing back of the twigs. Such injury is likely to occur in some degree at temperatures of —10°F. and almost certain to result when temperatures of —15°F. prevail. Varieties such as Reeve's, Early and Late Crawford and Mountain Rose are much more susceptible to bud injury than Greensboro, Carman and Belle. When temperatures of —15°F. and lower prevail some twig killing of the peach may occur in addition to bud killing.

Bud injury was very severe on peaches during the past winter from Monmouth County north to Bergen. In the vicinity of New Brunswick, the killing was practically complete, only an occasional bud coming into bloom in an entire orchard. Along the shore in Monmouth County, bud killing was much less severe and also in portions of Mercer and Morris counties. In Burlington County and south the bud injury was generally very light. At the experiment orchard at Vineland, practically no bud injury occurred even on such a variety as Mountain Rose, and a heavy set of peaches resulted. This was the case in many other orchards from Cumberland to Burlington County.

The splitting of the bark on the trunks of fruit trees during a severe winter is quite common in districts north of New Jersey, but some of this injury occurred in this state during the past winter. It was most severe on old peach trees and on such varieties of apples as Gravenstein and King. Where the bark splits down any distance along the trunk the edges soon start to curl back from the wood, which dries out and checks and splits. If the edges of split bark are tacked to the wood with a few tacks soon after the damage occurs, the extent of the injury can often be greatly reduced. If the injury is not treated until the bark becomes dry the latter should be cut back to the green portion and the exposed wood kept painted until it can be healed over by the growth of the tree.

Trunk splitting is of somewhat the same type of injury as bark splitting, but more severe. Occasionally the trunks of trees split to a depth of several inches and for considerable distances along the trunk. In severe cases on young fruit trees bolting may serve to draw the parts together and healing takes place more rapidly. Where the injury is only slight and in the case of large trees it is difficult to improve matters by bolting.

Collar Injury to Apples

A form of winter injury which is quite common over considerable areas in eastern United States, is damage to the bark on the trunk just at and below the surface of the ground. It is commonly termed "collar rot" and is quite generally understood by apple growers. It is apparently less well known among peach growers. Apple trees show the effects of winter killing of the bark at and below the collar of the tree by a check in the growth and by a lighter green or yellow color of the foliage. Where one side of a tree only is affected the branch or branches on that side indicate the injury, while the remainder of the tree commonly appears normal.

Varieties of apples that are especially susceptible to such injury in New Jersey are King, Gravenstein and Grimes. Baldwin is somewhat less susceptible than King, but was injured in many cases during the past winter. Duchess is commonly one of the most resistant varieties to winter injury, but about Matawan and Middletown in Monmouth County it has been especially susceptible to collar injury

Root Injury to Apples

Collar injury may extend to a stage of root injury where the damage to the bark includes that of the side roots for some distance out from the main root. In such cases if the trees are young they may die as soon as they begin to form leaves in early spring, and in severe cases old trees will do the same. Where collar injury is slight, however, the trees may not show the effects until later in the summer.

Another form of root injury is the killing of the tips which is most likely to occur in poorly drained soils. This rarely occurs on apples in New Jersey.

Collar Injury to Peaches.

Winter injury to the bark on the trunk and main root just at and below the surface of the soil has been quite common on peaches in New Jersey for a number of years, and the observations of the writer indicate that it frequently occurs in all eastern peach districts. Its various degrees are not generally recognized and the effects are attributed to other factors. In light cases the bark is injured only to an extent which checks wood growth and induces the production of large fruits with large dots or stomata, and a high tannin content, as previously reported. The lenticels of the bark are also greatly enlarged The injured bark often becomes yellow in color beneath the surface, and thickened, and lacks fiber and toughness. In still more severe cases the bark may be killed at certain points and the growth of the trunk checked. Where collar injury is severe the trees commonly bloom and set fruit, but die more or less suddenly from June to September. The light cases generally live through the first summer and may partially or completely recover if properly handled

Root Injury

During the past winter in New Jersey there were numerous cases of collar injury combined with root injury. Not only was the bark on the main root killed below the collar to a depth of 10 to 12 inches or more, but also that on the side roots to a distance of at least has decreased from 443 trees in 1917 to 176 trees in 1918, and from 1231 borers in 1917 to 414 borers in 1918. It will be noted also that

18 to 24 inches out from the main root and below the surface of the soil. Such trees bloomed and started to develop leaves, but they had a yellow appearance, and died in April and May.

This form of injury to peaches was most severe on the light, sandy soils from Middletown, N. J., south to Cumberland County. It appeared to be a form of dry freezing of the bark. Where more moist and heavier soil areas occurred in such orchards the injury was less severe or even entirely absent. The damage was almost entirely confined to trees of bearing age. Observations at this station indicate that the common form of collar injury to peaches occurs most frequently during winters of varying weather conditions, or during what are termed "open winters," when sufficiently warm periods occur to start the buds into activity.

The Variety Factor

There is a marked difference between varieties of different fruits in their susceptibility to winter injuries. There is one feature of collar injury to peaches which has been observed by the horticulturist in New Jersey that one does not find mentioned in articles on winter injuries. Plants of *Amygdalus davidiana,* secured from the United States Bureau of Plant Industry, have been growing on the station grounds for a number of years, and it has been reported as successfully withstanding a temperature as low as —40°F. in the West. The trees passed through the last winter at the College Farm without any apparent injury and the minimum temperature reached was —15° F. This plant, however, has suffered from collar injury in previous open winters and in such winters the blossom buds are killed. This peach blooms at least 10 days in advance of the standard varieties of peaches, and is readily started into growth during warm periods in winter.

Elberta is one of the most susceptible of the standard varieties to collar injury, and is one of the easiest to start into growth during warm periods. Varieties easily started into vegetative action appear to be the most subject to collar injuries. Such varieties of apples as Gravenstein, King and Baldwin, which suffer much from collar trouble, are all early blooming sorts, and make rapid development on the approach of spring. It is believed that this may be true ot other fruit trees.

PEACH INVESTIGATIONS AT VINELAND

Renovating An Old Orchard

As noted above the fertilizer experiments in Orchard No. 1, which was planted in 1907, were discontinued. This has now become the oldest orchard in the district in profitable commercial condition, and it offers an excellent opportunity to show what such an orchard can produce after its tenth year.

Some portions of the orchard have not received any nitrogenous fertilizers during the entire life of the trees, and they were in a very weak condition last spring, even though they have had phosphoric acid annually and potash until the outbreak of the war. The plan now is to fertilize this entire block in such a manner as to promote the best results.

The tops of some of the trees were becoming rather high and needed renewing. During the dormant season just passed, every alternate row in the orchard was "dehorned," severely cut back. The branches were cut back so that most trees had a spread of 6-8 feet in diameter. Wherever possible a large branch was cut off just beyond a small shoot or side branch. It has been learned that this operation should not be too severe. If large limbs are cut back close to the main trunk, and do not have any small, live limbs or shoots left on them, the trees often fail to throw out new growth, and finally die. Even if they do grow the shoots are likely to lack strength to support a heavy crop of fruit later. At the time this report is written, the dehorned trees are making a very vigorous growth. It was thought wise to tip the ends of the growing shoots that had made a foot or more growth to make them branch well. This was done with an ordinary grass hook or sickle. This instrument was found to be efficient in the rapid removal of the tips of the twigs.

The orchards have had a visitation by the peach twig borer, but the damage done does not amount to very much.

Thinning the Fruits.

Some experiments are being carried out to determine the rate of growth of the fruits of various varieties of peaches as affected by thinning the fruits at different stages.

Greensboro, Carman, Belle, Elberta and Stump are the varieties under observation. The first thinning was done just after the so-called "June drop" was ended. Two twigs that were closely set with fruits were allowed to remain as they were, three twigs were thinned so as to leave the fruits 4 inches apart; and three twigs, with the fruits 6 inches apart. Measurements were made at the widest part of the fruit. About three weeks after the first thinning, another set was thinned and it is planned to thin again three weeks later. Greensboro was thinned again about a week before ripening.

It was found that the fruits grow very slowly at this period up to about a week or ten days before ripening, when a spurt in growth is made. This latter fact was determined by measurements on Mayflower and Early Wheeler.

Fruits are being measured also on the J. H. Hale, Slappy, Salway, and Krummel's October varieties.

Relation Between the System of Pruning and Growth of Twigs and Fruit

During 1918 some special measurements are being made to determine the effect of different systems of pruning on the growth of twigs and fruit.

Trees were selected of each variety on each pruning plot at Vineland, and on each tree the growth of three terminal twigs is measured weekly and fruits on the older twigs from which the measured twigs emanate are calipered once in two weeks to learn the rate of growth.

The varieties are Elberta, Stump and Carman; the pruning treatments are "Not Pruned," "Winter-Pruned but Not Cut Back," "Winter-Pruned and Cut Back," "Winter and Summer-Pruned," and "Summer-Pruned Only." The trees are in the seventh summer's growth and have borne four crops of peaches.

Peach Yellows and Little Peach

A few cases of yellows and little peach have developed in the experimental orchards at Vineland this spring, and three trees have already been removed. One tree of the variety Hiley became diseased in 1917 with both yellows and little peach and was left for observation. The tree is diseased again this year with yellows and little peach on different branches. Attempts were made last fall to bud from these diseased limbs into other trees, but most of the buds have died. Further attempts of this sort will be made this year.

Peach Borer Observations at Vineland

As in previous years, a record was kept of the number of borers removed from each tree. Figure 1 shows a plan of the three orchards, each tree being represented by a rectangle, and within the rectangle is indicated the number of borers removed from each tree. The character of the surroundings may be determined by referring to diagram 1, opposite page 76, in the Annual Report of the New Jersey Agricultural Experiment Station Report for 1914.

The infestation by borers this year is very much lighter than in any previous year since the data have been kept. The areas that have been heretofore most lightly infested, that is the southwest corner of Orchard No. 1, the center and west borders of Orchard No. 2 and the center of Orchard No. 3, still maintain that position. The eastern border of Orchard No. 1 is still the most heavily infested part of the orchard. The eastern border of Orchard No. 3 is becoming more heavily infested because of the adjoining orchard.

Table 1 is a record of the number of trees infested and the number of borers that have been removed from each row in Ochard No. 1 for the years 1913 to 1918, inclusive. The infestation of this orchard the number of trees infested is approximately one-half of the number of trees that were infested in 1913. The number of borers found was about two-thirds of the number that was found in 1913. It will be noted also that row 13, which has been the check row in the borer treatment experiment, has still the largest number of borers, although the number of trees infested is two less than in rows 6 and 7. Row 13 has received no treatment whatever for borers outside of slightly mounding up the trees. Row 7, which had a very heavy infestation in 1917 (23 trees with 103 borers) has now the highest number of trees infested, namely 14, and almost the largest number of borers, 31. This is the row that received a treatment of white lead each year from 1913 to 1915. The other rows, except 1, 19, 25, 27, received a spraying of whitewash and lime-sulfur each year from 1913 to 1915. The rate of reduction in comparison with the check appears to indicate that this treatment has been partially effective against the infestation of borers.

Table 1

Records of Borers Found In Orchard No. 1

	May, 1913		May, 1914		May, 1915		May, 1916		May, 1917		May, 1918	
ROW	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found
1,	18	35	13	41	23	163	18	48	13	29	11	43
2,	13	24	15	51	24	156	18	51	12	39	7	18
3,	12	26	16	54	20	85	18	51	12	41	5	24
4,	11	22	18	72	25	222	12	28	9	20	2	5
5,	7	26	18	51	23	200	12	26	15	39	4	7
6,	16	55	23	115	24	224	23	135	19	59	14	30
7,	17	42	21	63	24	172	25	105	23	103	14	31
8,	11	18	22	94	24	200	7	9	12	36	7	15
9,	16	41	19	92	19	89	20	54	18	76	3	8
10,	13	31	17	54	22	109	9	12	15	56	5	8
11,	20	36	21	45	23	113	11	15	18	40	6	10
12,	11	22	21	77	22	124	10	23	12	19	4	5
13,	12	23	18	50	24	254	24	113	25	118	12	59
14,	13	22	13	29	18	70	19	53	19	51	9	25
15,	8	10	11	31	15	41	13	31	17	51	4	14
16,	9	14	11	32	18	68	13	36	14	33	6	10
17,	13	34	13	38	15	74	17	42	13	30	5	7
18,	11	18	15	47	21	87	14	34	21	63	3	9
19,	15	29	12	21	16	53	10	22	18	52	8	13
20,	6	14	15	36	17	73	11	21	16	40	3	10
21,	10	12	15	31	17	41	17	26	13	23	3	4
22,	13	23	12	29	12	25	14	26	21	35	7	5
23,	9	17	17	31	9	21	10	15	19	36	7	10
24,	8	18	12	37	11	28	9	10	14	25	3	3
25,	10	12	19	57	16	52	21	93	21	60	10	22
26,	8	16	9	22	9	14	16	19	13	25	4	5
27,	16	53	7	11	11	31	18	42	18	32	9	12
Total,	326	693	423	1311	502	2789	409	1140	440	1231	173	414

NOTE: Each row contains 25 trees.

Table 2 shows a record of the borers removed and the number of trees from which they were removed in Orchard No. 2 from May, 1913, to May, 1918, inclusive. Owing to the fact that the data for four rows were lost in 1917, double totals are given for each year, showing the total for all the rows and the total with these four rows omitted. It will be noted that the number of trees infested decreased from 329 in 1917 to 96 in 1918, and the number of borers found decreased from 623 in 1917 to 195 in 1918. There is also a considerable reduction over the number of trees and the number of borers found in 1913, the first year in which data were kept. In this orchard no row of 16 trees had more than 7 trees infested in 1918, while in 1917 row 20 had 15 trees and row 1 had 13 trees infested.

Table 2

Record of Borers Found In Orchard No. 2

ROW	May, 1913		May, 1914		May, 1915		May, 1916		May, 1917		May, 1918	
	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found
1, ...	16	20	15	70	15	117	15	130	13	60	3	9
2, ...	16	10	12	51	7	22	11	35	9	18	3	6
3, ...	11	15	10	22	10	28	10	32	9	23	5	9
4, ...	8	14	13	46	6	20	14	47	11	29	2	3
5, ...	6	18	11	30	9	22	14	50	9	28	3	5
6, ...	6	8	13	36	15	35	10	27	9	20	3	7
7.	11	22	9	27	9	12	13	32	.....	.....	0	0
8, ...	7	12	12	31	12	57	13	43	.....	.....	7	11
9, ...	3	44	12	20	7	12	13	31	9	19	0	0
10, ...	4	7	11	25	7	9	12	28	.....	.....	1	1
11, ...	4	4	10	33	11	24	14	25	6	11	2	2
12, ...	3	4	7	12	11	23	7	14	.....	.....	2	2
13, ...	4	7	8	18	7	12	12	36	11	. 22	4	5
14, ...	6	8	14	27	11	20	9	14	8	20	5	6
15, ...	7	11	9	16	3	3	10	14	9	25	2	2
16, ...	4	8	7	14	3	4	5	6	8	10	2	2
17, ...	6	7	9	12	9	14	12	24	10	18	0	0
18, ...	4	4	5	8	4	6	7	13	8	16	1	1
19, ...	5	5	7	8	4	6	6	10	9	15	2	2
20, ...	10	25	12	39	11	27	11	32	15	53	3	6
21, ...	4	10	11	21	13	34	9	18	12	28	0	0
22, ...	4	6	7	16	11	20	13	22	11	22	1	3
23, ...	6	11	12	24	9	16	13	37	12	45	1	1
24, ...	4	7	8	12	8	15	15	43	10	21	2	3
25, ...	5	8	10	16	6	11	12	26	12	38	3	3
26, ...	12	22	8	23	14	35	16	40	9	29	6	11
27, ...	6	12	7	23	7	20	9	29	10	25	1	1
28, ...	4	13	11	86	5	12	11	34	10	28	3	7
Total, ...	186	342	280	766	244	636	316	892	239	623	106	209
*Total, ...	161	297	241	561	205	535	271	775	239	623	96	195

* The results from Rows 7, 8, 10 and 12 are excluded for each year to make the comparison uniform.

NOTE: Each row contains 16 trees.

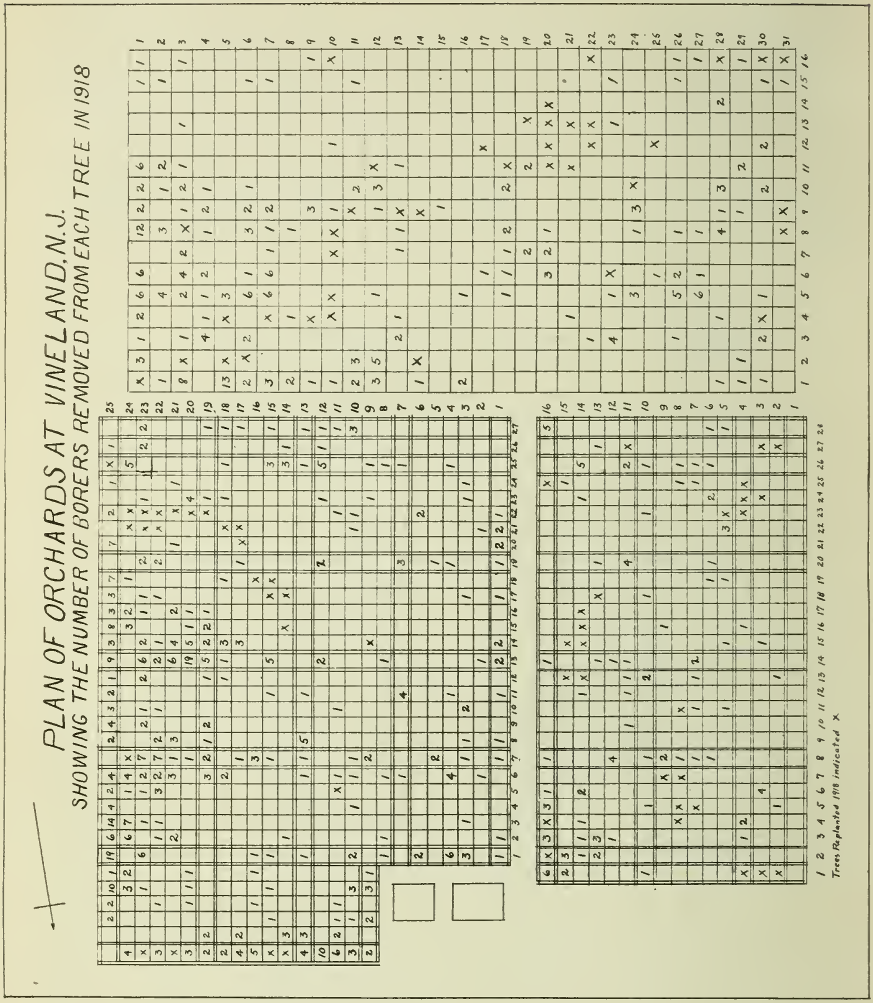
PLAN OF ORCHARDS AT VINELAND, N.J.
SHOWING THE NUMBER OF BORERS REMOVED FROM EACH TREE IN 1918
Trees Replanted 1918 indicated X

Fig. 1. Plan of Orchards at Vineland, showing the number of Borers removed from each tree in 1918.

Table 3 gives a record of the number of trees infested and the number of borers found in Orchard No. 3 for the years 1913 to 1918, inclusive. In this orchard also there is a considerable reduction in the number of trees infested and a 50 per cent reduction in the number of borers found. More trees were infested and more borers were found in 1918 than in 1913, the first year in which records were kept, but in 1913 the trees had been planted only one season. The trees which were planted in dynamited holes, namely rows 2, 4 and 7, still show the smallest number of trees infested and the smallest number of borers found in this orchard, in comparison with the trees that were planted in the usual manner, namely rows 1, 3, 5 and rows 6 and 8. This fact was noted in the report for 1917 and seems to hold true for the period since the planting of the orchard.

The general reduction in borer infestation throughout the orchard is probably due to several factors. In the first place, it is believed that the reduction is due largely to the work of parasites. Second, it is believed that possibly the thoroughness of worming may have been effective. Each spring the trees are gone over at least twice and sometimes three times. Even then, however, it is practically impossible to remove every borer, as they have been found frequently far down on the main roots. Third, the reduction may be due partly to the borer repellants that have been applied, as may be seen by comparing the infestation in row 7, Orchard No. 1 (table 1) with the infestation in the other rows in the orchard.

What part each factor has played has not been determined, but it is believed that each has had some effect in the gradual reduction of the infestation by borers.

Although no definite experiment with repellants was carried out in 1917, it was endeavored to learn what dosage of sodium cyanide trees would stand when applied in solution about the roots of the trees. Solutions of the strength of one-fourth ounce, one-half ounce, one ounce and 2 ounces to the gallon were applied about the roots of the trees in the spring.

It was found that 1 year old trees safely resisted the one-fourth ounce and the one-half ounce dosages. Slight injury was caused by 1-ounce and the 2-ounce dose killed one tree. Trees that were four or five years old were seriously injured by the 2-ounce dose only. It would seem that three-fourths ounce of sodium cyanide can be safely applied to trees of all ages, provided they are growing vigorously.

Very few borers were found in the trees near the treated trees, so the lack of infestation in the treated trees gives no indication of the efficiency of the material as a controller. However, earlier experiments have shown that this material will kill borers.

Table 3

Record of Borers Found In Orchard 3

ROW	May, 1913		May, 1914		May, 1915		May, 1916		May, 1917		May, 1918	
	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found	No. trees infested	No. borers found
1, ...	9	14	9	28	20	56	22	75	22	66	15	42
2, ...	9	11	10	13	22	50	17	52	10	17	4	12
3, ...	17	25	21	54	27	187	28	106	19	40	9	18
4, ...	11	14	8	12	13	28	9	30	9	15	7	8
5, ...	14	21	18	35	23	90	27	87	19	59	15	47
6, ...	8	11	14	29	13	28	18	87	13	29	11	28
7, ...	5	5	3	5	9	15	11	18	7	10	6	9
8, ...	1	3	10	18	23	65	17	52	16	43	13	32
9, ...	3	3	7	11	11	29	14	34	19	38	12	20
10, ...	6	12	8	10	11	19	15	47	14	37	10	19
11, ...	6	6	4	7	11	22	16	43	15	27	6	14
12, ...	6	10	11	34	13	28	12	45	10	23	2	3
13, ...	3	3	8	9	14	17	20	39	15	30	2	2
14, ...	6	8	6	17	14	27	10	50	13	31	1	2
15, ...	5	8	9	12	19	48	19	45	11	25	9	9
16, ...	7	11	9	25	10	18	15	65	16	46	6	6
Total, ...	116	165	155	319	253	727	270	875	228	536	128	271

NOTE: Each row contains 31 trees.

PEACH BREEDING

During the period since the last report, no actual breeding of peaches was carried out, but the seedlings secured from the crosses made in the spring of 1916 were set in orchard form. These included the following:

	No Trees		No Trees
Lola S. P.	86	Slappey x Dewey	40
Lola x Arp	55	Early Crawford S. P..........	25
Lola x Early Crawford........	70	Early Crawford x Slappey......	30
Lola x Slappey...............	38	Early Crawford x Dewey.......	5
Slappey S. P.................	12	Early Crawford x Arp.........	9
Slappey x Arp................	31	Carman S. P................	20
Slappey x Early Crawford.....	7	Carman x Slappey............	4

A number of fruit buds had set on the seedlings that were planted in the orchard in 1916, but because of the extremely cold weather in the past winter, all the buds were killed. All previous plantings of seedlings are making a vigorous growth, so if conditions are favorable a good set of fruit should be secured next season. Also the varieties that were planted in the spring of 1917 are making good growth.

During the season of 1917, a bud sport was found at Vineland on the variety Burke, in which the leaves were varigated, white and green. This will be propagated as a horticultural variety.

HOW MANY FLOWER BUDS DOES A PEACH TREE DEVELOP?

One is more interested in how many fruits a peach tree of a certain age will mature than in the number of fruit buds it may set. However, there is much of practical interest in the latter. During February, 1916, the senior class in horticulture at Rutgers College cut twigs from the different portions of a number of peach trees and determined the number of buds per inch of twig growth. The number of buds varies with the variety, age of tree and the season. However, the twigs examined were from trees of the Carman type and would fairly represent a good set of buds on such varieties.

One thousand and eighty-six feet of twig growth was actually examined. An average of 12.7 buds per foot was found which is a little more than one bud per inch. This may appear to be a low average to one who examines but a few twigs on which the flower buds appear to be thickly clustered, but is really a good average when the entire amount of annual twig growth is considered, since the larger twigs may not carry any fruit buds on the more vigorous portions.

Should all of the flowers set fruits at an average distance of one inch apart, these remaining on the twigs until maturity, the tree would break down with the load of small, undersized specimens. It would be impossible for a tree to develop such a set of fruit to a good commercial size.

Where there is a good set of fruit on a tree the specimens should not be left closer than 6 inches apart on the twigs and with such varieties as Waddell, Carman and Early Crawford, 8 inches is better. This means that one-sixth of the flower buds are ample for a crop if each one sets and matures a fruit.

Occasionally, reports of at least 50 per cent injury to flower buds of the peach precede the harvesting of a full crop, and it is readily seen how such a loss might have but little effect upon the amount of the crop. It may be of interest to note further the amount of twig growth which a young peach tree might make and the resulting number of fruit buds that would form.

In the pruning experiments at Vineland, N. J., Carman trees made averages of from 5119 to 11,320 inches of twig growth the third season after planting, and individual trees exceeded a total of 14,000 inches. Trees making a total twig growth of 6,000 inches would then have about 6,350 fruit buds if the set was good, while trees with a total of 12,000 inches of growth would have double the number, or 12,700 buds.

A good crop of peaches the fourth season after planting would be from 5 to 6 baskets per tree, while in exceptional cases from 7 to 8 or more might be obtained. If all the peaches from a young Carman tree of this age and size averaged 7¼ inches in equatorial circumference, they could be considered of good size. It would require about 116 to 120 of such fruits to fill a 16-quart basket. Therefore, a production of five or six baskets per tree might mean from 580 to 720 mature fruits, while a production of from 7 to 8 baskets might mean from 812 to 960 fruits.

From these figures it may be noted that a comparatively small proportion of the fruit buds which form on a peach tree of the Carman type are required for the production of a full crop of fruit. It must be remembered, however, that weather injuries destroy a certain number and then lack of pollination, the curculio, brown rot and numerous other factors take their toll. It is apparent, however, that the peach appears to endeavor to form such a quantity of buds that plenty will remain to produce a crop even though destructive agencies destroy great numbers.

Blooming Dates of Fruit Trees at the College Farm

Because of the early closing of college it was not possible to secure a student to obtain the blooming dates of the various ornamental and fruit-bearing trees, shrubs and vines on the College Farm. There was no bloom on peaches, but blooming notes were kept in part for apples and pears, as are presented in the following tables.

Table 4

Blooming Dates of Standard Apples, 1918

	First Bloom	Full Bloom
Baldwin	5- 1	5- 5
Banana	5- 1	5- 5
Ben Davis	5- 1	5- 5
Broome**	5- 3	5- 7
Clinton**	5- 2	5- 5
Collins (Stark Champion)*	4-30	5- 5
Delicious	4-30	5- 5
Delicious*	5- 1	5- 5

Gilbert	5- 1	5- 5
Gravenstein	....	5- 2
Henry Clay	4-28	5- 3
Jonathan	5- 1	5- 5
June (Stark)*	5- 1	5- 6
King David*	5- 1	5- 5
Monmouth	4-30	5- 3
Montgomery**	5- 2	5- 5
Nassau**	5- 5	5- 7
Oldenburg	....	5- 2
Otsego**	5- 2	5- 5
Rockland**	5- 2	5- 6
Rome*	5- 2	5- 7
Saratoga**	5- 1	5- 5
Smith	5- 2	5- 5
Stayman*	4-29	5- 5
(Tomkins) King	....	5- 3
Wealthy*	5- 2	5- 6
Williams	5- 2	5- 6
Winterstein*	5- 1	5- 5
Yellow Trasparent	5- 3	5- 6

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*Young trees.

**Young trees of varieties originated at the New York Agricultural Experiment Station, Geneva.

Table 5

Blooming Dates of Dwarf Apples, 1918.

	First Bloom	Full Bloom
Alexander	5- 1	5- 5
Baldwin	4-30	5- 5
Banana	5- 1	5- 5
Bietigheimer	4-30	5- 3
Chenango	5- 2	5- 6
Delicious	5- 1	5- 5
Fall Pippin	5- 2	5- 5
Gravenstein	....	5- 3
Henry Clay	....	5- 2
Jonathan	....	5- 5
King David	5- 1	5- 5
Oldenburg (Duchess)	....	5- 3
Opalescent	5- 2	5- 5
Red Astrachan	....	5- 2
Rhode Island Greening	5- 1	5- 5
Roxbury	5- 1	5- 5
Sutton	5- 2	5- 5
Twenty Ounce	5- 1	5- 5
Wealthy	5- 1	5- 7
Westfield	5- 2	5- 5

Table 6

Blooming Dates of Standard Pears, 1918

	First Bloom	Full Bloom
Anjou	....	4-30
Barsec	....	5- 1
Bartlett	....	5- 1
Clapp Favorite	....	5- 1
Clairgeau	....	4-28
Comice	4-28	....
Dorset	....	4-30
Duchess	....	5- 1
Early Wilder	....	5- 1
Easter	....	5- 1
Flemish Beauty	....	4-30
Fred Clapp	....	4-30
Garber	....	4-28
Golden Russet	....	5- 2
Howell	....	4-29
Idaho	....	5- 2
Kieffer	....	4-30
Lady Clapp	....	5- 2
Lawrence	....	4-29
Le Conte	....	5- 1
Malines	....	5- 1
Manning Elizabeth	....	5- 2
P. Barry	....	5- 2
Rutter	....	5- 1
Seckel	....	5- 1
Sheldon	....	5- 2
Vermont	....	5- 3
Winter Nelis	....	5- 2
Worden—Seckel	....	5- 1

Table 7

Blooming Dates of Dwarf Pears, 1918

	Full Bloom
Anjou	4-30
Duchess	4-29
Easter	4-29
Howell	4-30
Louise	5- 1

STRAWBERRY VARIETY TESTS

Strawberry variety tests have been conducted at the New Jersey Agricultural Experiment Station for a number of years, and have formed the basis of much advice that has been given to growers by lectures and by correspondence. The dates at which a considerable number of varieties have ripened at the College Farm, and when they produced the bulk of their crop have been recorded and are now presented in tabular form.

Table 8

Record of Yield of Strawberry Test Plot at the College Farm Planted in the Spring of 1910.

VARIETY	1911			1912		
	First Picking	Heaviest Picking	Bulk of Crop	First Picking	Heaviest Picking	Bulk of Crop
	June	June	June	June	June	June
Abington,	3	10	10-14	10	12	10-19
Barrymore,	5	14	10-14	10	14, 19, 24	14-24
Beder Wood,	3	10	5-17	10	12	12-16
Black Beauty,	3	12	10-14	10	19	14-24
Bountiful,	3	10	10-17	10	12	10-19
Bubach,	3	10	5-14	10	16	10-19
Chipman,	5	10	10-14	10	10	10-19
Columbia,	10	14	10-14	10	16	14-19
Cooper,	5	10	10-17	10	16, 19	14-19
Crimson Cluster,	10	14, 17	12-20	17	24	19-24
Ekey,	5	10	10-14	13	17	17-24
Fairfield,	3	10	5-14	10	16	10-16
Fendall,	10	17	10-17	10	16	16-24
Senator Dunlap,	3	10	10-14	..	..	..-..
Glastonbury,	5	12	10-14	10	16	12-19
Glen Mary,	5	10	10-14	10	16	12-19
Gold's Taft,	10	17	10-20	10	24	19-24
Great Scott,	5	10	10-20	10	16	16-24
Helen Gould,	10	12, 14, 17	10-20	10	16	14-24
Heritage,	10	17	10-20	13	19	17-19
Highland,	5	10	10-14	10	12, 16	10-19
Howard's 17,	3	10	5-17	10	12	10-16
Joe,	10	12	10-20	10	16	12-19
July,	5	20	12-23	10	16	16-26
Hewitt's Wonder,	5	10	10-17	10	16	14-19
Mead,	10	17	12-20	10	16	12-19
Meteor,	10	20	12-23	12	19	17-26
Mrs. Fisher,	10	17	12-23	12	19	17-24
Oswego,	3	14	10-14	12	14, 17, 19	14-19
Paul Jones,	5	17	10-20	10	16, 19	12-19
President,	5	10	10-14	12	17	17-21
Sample,	5	10, 17	10-20	12	12, 24	12-19
Saratoga,	5	12, 14	10-17	12	17	12-19
Stevens,	10	14	12-20	12	17	14-19
Superior,	3	10	10-14	12	12	12-19
William Belt,	5	14	10-17	12	17	12-19
Wonder,	10	10	10-17	12	17	12-19
Wooster,	3	10	10-17	12	12	12-17
Three W,	5	10	10-17	12	12, 14, 17	12-17

Table 9

Record of Yield of Strawberry Test Plot at the College Farm, Planted in the Spring of 1911

VARIETY	1912			1913		
	First Picking	Heaviest Picking	Bulk of Crop	First Picking	Heaviest Picking	Bulk of Crop
Barrymore,	6/10	6/14	6/12-19	5/29	6/12, 13	6/ 2-23
Black Beauty,	6/10	6/17	6/10-19	6/ 2	6/12, 13	6/ 5-18
Columbia,	6/10	6/17	6/12-19	5/29	6/12, 13	6/ 5-18
Crimson Cluster,	6/14	6/17	6/17-24	6/ 2	6/12, 13	6/12-23
Cooper,	6/10	6/14, 17,19,22	6/14-22	6/ 5	6/12, 13	6/ 5-23
Ekey,	6/10	6/17	6/12-19	5/26	6/12, 13	6/ 9-23
Glastonbury,	6/10	6/10	6/10-17	5/29	6/ 5	6/ 2-10
Gold's Taft,	6/10	6/10, 19, 22	6/10-22	6/ 2	6/12, 13	6/ 9-18
Helen Gould,	6/10	6/17, 19	6/10-19	5/26	6/12, 13	6/ 5-13
Highland,	6/10	6/14	6/10-17	5/26	6/ 2, 3	6/ 2-18
Howard's 17,	6/10	6/14	6/10-17	5/26	6/ 2, 3	6/ 2-13
July,	6/10	6/17	6/12-26	6/ 2	6/21, 23	6/ 9-23
Kevitt's Wonder,	6/10	6/24	6/10-24	5/26	6/ 2, 3	6/ 2-10
Manhattan,	6/10	6/19	6/14-24	5/29	6/16, 18	6/ 5-23
Mrs. Fisher,	6/10	6/17, 19	6/17-22	6/ 2	6/12, 13	6/ 5-18
Oswego,	6/10	6/17	6/12-19	5/26	6/12, 13	6/ 9-18
Paul Jones,	6/10	6/12, 17, 19	6/12-24	5/26	6/ 9, 10	6/ 9-18
Sample,	6/10	6/17	6/12-24	6/ 2	6/ 9, 10	6/ 9-18
Saratoga,	6/10	6/12, 24	6/12-24	5/29	6/ 9, 10	6/ 5-18
Stevens,	6/10	6/17	6/14-24	6/ 2	6/12, 13	6/ 9-18
Wm. Belt,	6/10	6/22	6/14-22	5/29	6/ 9, 10	6/ 9-23
Wonder,	6/10	6/17	6/14-19	5/26	6/ 2, 3	6/ 2-18
Wooster,	6/10	6/17	6/12-19	5/26	6/ 2, 3	6/ 2-13
Fairfield,	6/10	6/11	6/10-14	5/26	6/ 2, 3	5/26-6/ 3
Gandy,	6/10	6/12	6/12-17	5/26	6/ 2, 3	5/29-6/13
Joe,	6/12	6/17, 24	6/13-24	5/29	6/ 9, 10	6/ 5-23
Heritage,	6/12	6/24, 26	6/14-26	6/ 2	6/ 9, 10	6/ 5-18
Meteor,	6/12	6/19	6/14-19	6/ 2	6/12, 13	6/ 9-23

Table 10

Record of Yield of Strawberry Test Plot at the College Farm, Set In August, 1913

VARIETY	1914			1915		
	First Picking	Heaviest Picking	Bulk of Crop	First Picking	Heaviest Picking	Bulk of Crop
	June	June	June	June	June	June
Amanda,	8	15	11-21	10	17	10-21
Barrymore,	5	15	11-19	10	17	12-17
Black Beauty,	11	17	11-21	10	17	14-21
Chesapeake,	11	13	11-21	10	19	12-21
Columbia,	5	11	8-17	10	19	14-21
Crimson Cluster,	11	15	13-21	12	19	17-23
Ekey,	11	17	11-19	10	17	14-19
Fairfield,	1	11	3-11	4	7	4-12
Fendall,	11	17	11-23	10	19	12-23
Howard's 17,	5	11	8-15	7	10	10-17
Joe,	11	15	11-21	10	14	10-21
Hewitt's,	5	11	11-17	7	10	10-21
Manhattan,	8	15	11-21	10	17	12-21
Marie,	5	11	8-17	7	12	10-16
Prolific,	11	15	13-21	10	17	14-23
Quality,	15	19	15-21	14	21	16-21
Sample,	5	15	11-21	12	21	12-23
Senator Dunlap,	5	11	11-17	10	16	10-21
Stevens,	11	21	15-21	10	17, 21	16-23
Wm. Belt,	11	11	11-21	10	17	16-17

Table 11

Record of Yield (1915) of Strawberry Test Plot at the College Farm, Set in the Spring of 1914.

VARIETY	First Picking	Heaviest Picking	Bulk of Crop
	June	June	June
Abington,	7	14	9-17
Americus,	9	9	9-15
Aroma,	9	15, 21	14-21
Collingwood,	9	16, 18	16-18
Caroline,	11	11, 14, 21	11-21
Columbia,	9	16	11-18
Barrymore,	7	17	14-21
Bubach,	9	14	9-14
Doris,	11	17	17-25
Early Jersey Giant,	7	7	7-14
Early Ozark,	7	9	7-14
Enormous,	11	14	12-23
Quality,	9	12, 14	12-21
Gandy,	9	17, 18	11-23
Haverland,	7	14	12-18
Howard No. 17,	7	11	9-17

Table 12

Record of Yield of Strawberry Test Plot at the College Farm, Planted in the Spring of 1915

VARIETY	1916			1917		
	First Picking	Heaviest Picking	Bulk of Crop	First Picking	Heaviest Picking	Bulk of Crop
Early Campbell,	6/10	6/15	6/13-6/21	6/14	6/22	6/18-6/27
Missionary,	6/10	6/13	6/13-6/22	6/14	6/27	6/18-6/27
Early Ozark,	6/10	6/21	6/13-6/27	6/14	6/18	6/14-6/25
Kellogg's Premier,	6/27	6/27	6/13-6/30	/618	6/22	6/18-6/27
Monroe,	6/10	6/27	6/20-6/27	6/15	6/25	6/22-7/ 2
Howard's 17,	6/10	6/27	6/17-6/30	6/15	6/22	6/22-6/27
Edward Wilson,	6/10	6/27	6/20-6/27	6/18	6/25	6/20-6/27
Early Jersey Giant,	6/10	6/20	6/13-6/27	6/15	6/18	6/18-6/25
Fairfield,	6/10	6/13	6/10-6/20	6/18	6/18	6/18-6/22
Americus,	6/13	6/13	6/13-6/27	6/15	6/20	6/18-6/22
Progressive,	6/13	6/27	6/13-6/27	6/15	6/18	6/18-6/22
Caroline,	6/13	6/22	6/17-6/27	6/15	6/22	6/22-6/27
Nellis Triumph,	6/13	6/19	6/19-6/30	6/14	6/25	6/22-6/26
John H. Cook,	6/13	6/20	6/15-6/27	6/15	6/25	6/20-6/27
Shropshire,	6/15	6/27	6/15-6/27	6/22	6/27	6/22-7/ 2
Marshall,	6/15	6/27	6/19-6/27	6/14	6/22	6/22-6/27
Klondyke,	6/15	6/27	6/15-6/30	6/14	6/26	6/20-6/26
Twilley,	6/15	6/27	6/19-6/30	6/14	6/25	6/22-6/29
T. R. Hunt, No. 16,	6/15	6/27	6/24-7/ 3	6/20	6/27	6/25-7/ 5
Success,	6/15	6/20	6/20-6/27	6/18	6/27	6/22-6/27
Marie,	6/15	6/20	6/20-6/27	6/15	6/25	6/22-6/27
Advance,	6/17	6/27	6/21-7/ 3	6/15	6/25	6/25-6/29
Onward,	6/17	6/27	6/19-6/27	6/15	6/27	6/22-6/27
Warren,	6/17	6/19	6/17-6/30	6/18	6/25	6/25-6/29
Indiana,	6/17	6/27	6/20-6/27	6/22	6/25	6/22-6/25
Joe Johnson,	6/17	6/27	6/17-6/30	6/18	6/26	6/22-6/27
Big Joe,	6/17	6/27	6/19-6/30	6/18	6/27	6/22-6/29
Rewastico,	6/17	6/27	6/22-6/30	6/20	6/26	6/26-7/ 2
Uncle Jim,	6/17	6/30	6/22-6/30	6/18	6/27	6/22-6/27
Doris,	6/17	6/30	6/21-6/30	6/22	6/29	6/27-7/ 2
Forward,	6/17	6/27	6/21-6/30	6/15	6/27	6/20-6/27
Joe Johnson E. W. T.,	6/19	6/27	6/24-7/ 6	6/20	6/27	6/25-7/ 2
Emerson Joe,	6/19	6/30	6/24-7/ 3	6/30	6/27	6/25-7/ 2
Superb,	6/19	6/27	6/24-6/30	6/15	6/25	6/25-6/27
Production,	6/19	6/27	6/22-6/30	6/18	6/25	6/20-6/27
Superb (Kellogg),	6/19	6/27	6/24-6/30	6/15	6/20	6/20-6/27
Barrymore,	6/19	6/30	6/24-6/30	6/20	6/25	6/25-6/29
Columbia,	6/19	6/27	6/22-6/30	6/14	6/22	6/22-6/29
Enormous,	6/19	6/30	6/27-7/ 3	6/20	6/26	6/22-7/ 2
William Belt,	6/19	6/30	6/27-7/ 6	6/20	6/25	6/25-6/26
Sample,	6/19	6/27	6/22-7/ 3	6/18	7/ 2	6/25-7/ 2
First Quality,	6/19	6/27	6/24-6/30	6/20	6/26	6/22-6/29
Chesapeake,	6/19	6/27	6/24-7/ 3	6/20	6/26	6/25-6/29
McAlpin,	6/19	6/27	6/24-7/ 3	6/20	6/26	6/25-6/26
Bucks,	6/20	6/27	6/24-6/30	6/20	6/27	6/25-7/ 2
Collingwood,	6/20	6/27	6/22-7/ 3	6/20	6/25	6/25-7/ 2
Mascott,	6/21	6/30	6/24-6/30	6/18	6/27	6/27-7/ 5
Late Jersey Giant,	6/22	6/27	6/22-6/30	6/18	6/27	6/22-7/ 2
Kellogg's Prize,	6/22	6/30	6/27-7/ 6	6/18	6/27	6/25-7/ 2
Prolific,	6/22	6/27	6/27-6/30	6/20	6/29	6/25-7/ 2
Monroe,	6/22	6/27	6/22-6/30	6/20	6/29	6/27-7/ 2
Joe,	6/22	6/27	6/22-7/ 3	6/18	6/27	6/25-6/29
Gandy,	6/22	6/27	6/24-7/ 3	6/22	6/27	6/27-7/ 2
Helen Davis,	6/24	6/27	6/24-6/30	6/20	6/26	6/25-6/29
Lady Corneille,	6/27	6/27	6/27-6/30	6/18	6/26	6/22-6/26

Table 13

Record of Yield of Strawberry Test Plot at the College Farm, Planted in the Spring of 1916

VARIETY	1917			1918		
	First Picking	Heaviest Picking	Bulk of Crop	First Picking	Heaviest Picking	Bulk of Crop
Uncle Jim,	6/ 8	6/22	6/20-6/27	5/31	6/11	6/ 5-6/11
Premier,	6/15	6/25	6/18-6/27	5/25	6/11	5/29-6/11
Big Joe,	6/16	6/22	6/22-6/27	5/31	6/11	6/ 7-6/11
Mascott,	6/22	7/ 2	6/25-7/ 2	5/31	6/11	6/11
Enormous,	6/22	7/ 2	6/25-7/ 5	6/ 3	6/11	6/11-6/14
Monroe,	6/22	6/25	6/25-6/27	6/ 7	6/11	6/ 7-6/14
Missionary,	6/15	6/25	6/20-7/ 2	5/27	6/11	6/ 3-6/11
Twilley,	6/16	6/25	6/20-6/27	6/ 3	6/ 5	6/ 5-6/13
William Belt,	6/16	7/ 2	6/25-7/ 5	6/ 3	6/11	6/ 5-6/11
Emerson Joe,	6/16	7/ 2	6/25-7/ 5	5/31	6/11	6/ 5-6/13
Joe,	6/22	6/25	6/25-7/ 2	6/ 5	6/11	6/ 5-6/14
Sample,	6/16	6/25	6/25-7/ 2	5/29	6/12	6/ 5-6/20
Joe Johnson,	6/16	6/25	6/22-7/ 2	6/ 3	6/ 5	6/ 5-6/14
Shropshire,	6/18	7/ 2	6/22-7/ 2	6/ 3	6/11	6/ 3-6/14
Early Campbell,	6/15	6/20	6/25-6/25	5/23	6/ 3	5/27-6/ 5
Helen Davis,	6/16	6/25	6/20-7/ 2	5/31	6/ 5	6/ 3-6/14
Rewastico,	6/20	6/25	6/22-7/ 2	5/31	6/11	6/ 3-6/11
Barrymore,	6/16	6/25	6/22-6/29	5/29	6/11	6 /5-6/11
Columbia,	6/20	6/25	6/25-6/29	5/31	6/ 7	6/ 3-6/11
Klondike,	6/15	6/25	6/20-6/25	5/25	6/ 3	6/ 3-6/12
McAlpin,	6/16	6/25	6/20-6/29	6/ 3	6/12	6/ 7-6/14
Early Ozark,	6/15	6/25	6/15-6/25	5/23	5/29	5/27-6/ 7
Prolific,	6/20	6/25	6/25-7/ 2	6/ 3	6/ 7	6/ 5-6/14
Lady Corneille,	6/22	6/25	6/25-6/29	5/29	6/ 7	6/ 5-6/11
Doris,	6/20	6/29	6/22-6/29	6/ 5	6/11	6/11-6/18
Howard 17,	6/15	6/25	6/18-6/27	5/25	6/11	6/ 3-6/11
Collingwood,	6/20	6/25	6/22-7/ 2	5/31	6/ 5	6/ 5-6/11
Warren B,	6/18	6/25	6/22-6/25	5/31	6/11	6/ 5-6/11
Superb,	6/15	6/25	6/20-6/29	5/27	6/ 5	6/ 3-6/11
T. R. Hunt No. 16,	6/18	6/25	6/22-6/29	5/29	6/12	6/ 5-6/18
Caroline,	6/20	6/25	6/22-6/25	6/ 5	6/11	6/ 7-6/11
Edward Wilson,	6/18	6/25	6/20-6/29	5/27	6/13	6/ 3-6/13
Productive,	6/18	6/25	6/22-6/29	5/29	6/11	6/ 3-6/13
Chesapeake,	6/20	6/25	6/22-7/ 2	6/ 3	6/11	6/ 5-6/13
Gandy,	6/22	6/25	6/25-7/ 2	6/ 3	6/11	6/11-6/20
Marshall,	6/15	6/25	6/20-6/27	5/27	6/13	6/ 3-6/13
Progressive,	6/15	6/16	6/16-6/20	5/25	6/ 5	5/27-6/ 5
John H. Cook,	6/15	6/25	6/20-6/29	5/27	6/11	6/ 5-6/11
Early Jersey Giant,	6/15	6/25	6/20-6/25	5/25	6/ 3	6/ 3-6/13
Bucks,	6/20	6/25	6/22-7/ 2	5/31	6/11	6/ 5-6/11
Late Jersey Giant,	6/20	6/25	6/25-6/29	6/ 3	6/11	6/ 3-6/14
Indiana,	6/16	6/25	6/22-6/29	5/29	6/11	6/ 3-6/11
Marie,	6/15	6/25	6/20-6/25	5/27	6/ 7	6/ 3-6/11
First Quality,	6/16	6/25	6/22-7/ 2	5/29	6/ 7	5/ 3-6/13
Advance,	6/16	6/25	6/20-6/29	5/27	6/ 7	5/29-6/11
Superb,	6/15	6/25	6/20-6/27	5/27	6/ 3	5/29-6/ 7
Forward,	6/15	6/25	6/18-6/27	5/27	6/11	6/ 3-6/11
Success,	6/15	6/25	6/20-6/27	5/27	6/ 7	6/ 3-6/11

Table 14

Record of Yield (1918) of Strawberry Test Plot at the College Farm, Planted in the Spring of 1917.

VARIETY	First Picking	Heaviest Picking	Bulk of Crop
Jocunda,	5/29	6/11	6/ 3-6/11
Oregon Improved,	5/27	6/11	6/ 3-6/11
Amanda,	5/27	6/ 3	5/29-6/11
No. 48, S. P. 2,	5/23	5/29	5/29-6/ 3
No. 86, S. V. B.,	5/25	6/ 3	5/29-6/11
Elate,	5/29	6/11	6/ 3-6/11
Early Queen,	5/23	6/11	5/29-6/11
Luther,	5/25	5/29	5/29-6/ 5
Collins,	5/29	6/ 3	6/ 3-6/13
Gibson,	5/29	6/13	6/ 3-6/13
Francis Willard,	5/29	6/11	6/ 3-6/11
Barkley,	5/31	6/ 7	6/ 3-6/11
World's Wonder,	5/27	6/ 7	6/ 5-6/11
Sherman,	5/27	6/ 7	6/ 3-6/11
Townsend's Late,	6/ 3	6/ 3	6/ 3-6/11
Ford,	5/29	6/11	6/ 3-6/11
Baltimore,	5/27	6/11	5/29-6/11
Missionary,	5/25	6/ 3	5/27-6/ 5
Mathews,	5/23	6/ 3	5/27-6/ 5
Maples Early,	5/23	6/ 3	5/29-6/ 5
Pride of Cumberland,	5/27	6/11	6/ 3-6/11
Ryckman,	5/27	6/ 3	6/ 3-6/11
Aroma,	5/27	6/ 3	6/ 3-6/11
Lupton,	5/31	6/ 3	6/ 3-6/ 7
Darlington,	5/27	6/ 3	6/ 3-6/11
Early Surprise,	5/27	6/ 3	5/29-6/11
Peerless,	5/29	6/ 5	6/ 3-6/11
Dr. Burrell,	5/27	6/ 5	5/29-6/11
Howard's 17,	5/23	6/ 3	5/29-6/ 5
Longfellow,	5/27	6/ 3	6/ 3-6/ 7
Clark Seedling,	5/27	6/ 3	5/ 3-6/ 7
Magoon,	5/27	6/11	5/31-6/11
Nellis Triumph,	5/29	6/ 3	6/ 3-6/11
Sunrise,	5/29	6/ 3	6/ 3-6/1[illegible]
Gikon,	5/29	6/12	6/ 3-6/14
T. R. Hunt No. 10,	5/29	6/ 3	6/ 3-6/14
Liberty Bell,	6/ 3	6/ 3	6/ 3-6/12
McAlpin,	5/29	6/12	6/ 3-6/12
Joe Johnson,	5/29	6/ 7	5/29-6/12
Barrymore,	5/29	6/12	5/29-6/12
T. R. Hunt No. 16,	6/ 3	6/ 3	6/ 3-6/12
Prolific,	5/31	6/12	6/ 3-6/12
Missionary,	5/23	6/ 3	5/27-6/ 5
Big Joe,	6/ 3	6/12	6/ 3-6/12
Premier,	5/27	6/ 3	5/29-6/ 7
Sample,	5/29	6/ 3	6/ 3-6/12
Hustler,	6/ 3	6/12	6/ 7-6/12
Early Woodrow,	5/29	6/ 7	6/ 3-6/12
Pearl,	5/31	6/ 3	6/ 3-6/12
Ewell's Early,	5/23	6/ 3	6/ 3-6/12
Chester,	6/ 3	6/12	6/ 3-6/12
Billy Sunday,	5/29	6/12	6/ 3-6/12
Bradley,	5/27	6/12	6/ 3-6/12
Winner,	5/27	6/12	5/29-6/12
Magic Gem,	5/31	6/12	6/ 3-6/12
La Bou,	5/27	6/ 3	6/ 3-6/ 7

WEATHER OBSERVATIONS

The weather observations from November 1, 1917, to July 1, 1918, were taken by Prof. A. J. Farley and Mr. William Schieferstein.

November was an exceedingly dry month at the College Farm, with a total rainfall of 0.49 inches, which was 2.81 inches below normal. This was the dryest month of November since records have been kept by the horticultural department. The rainfall continued to be below normal during December, January and February. This dry condition may have had some influence upon the amount of winter injury which followed to fruit trees and other plants.

Exceptionally cold weather prevailed beginning early in December and extending into February. There was snow and ice on the ground for the greater portion of the winter.

The maximum temperature for December was 32.9°, the lowest recorded for December at the College Farm. From December 29, 1917, to January 4, 1918, the minimum ranged from —15°F. to + 3°F., practically a week of zero temperatures. January was exceptionally cold, the mean maximum being 27.7°F. and the mean minimum 2.7°F. These are the lowest recorded at the College Farm for any month of January. The coldest day was December 30, with a minimum of —15°F.

The severity of the winter greatly interfered with pruning work in orchards and outside farm work in general.

The monthly maximum and minimum means of temperature from November 1, 1917, to July 1, 1918, were as follows:

	Minimum.	Minimum.
November	50.0°F.	29.9°F.
December	32.9	18.0
January	27.7	12.7
February	39.4	19.5
March	53.9	31.0
April	59.9	40.1
May	77.9	53.6
June	77.6	56.6

Table 15

Daily and Monthly Precipitation In Inches at the College Farm November 1, 1917, to July 1, 1918

DATE	1917 Nov.	1917 Dec.	1918 Feb.	1918 Jan.	1918 March	1918 April	1918 May	1918 June
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
1		1.00			0.03		0.85	
2				T				
3			0.04			0.22		
4						0.11	0.29	
5			T		0.18			
6					0.04		0.01	0.64
7			0.02	0.51	0.19			0.64
8		0.74				0.01	0.01	
9		0.06	0.21		0.02	0.33		
10					0.20	0.31		
11						0.22	0.08	1.34
12		T		0.64	0.02	0.57	0.01	0.26
13		T				0.05		
14		1.08			0.84	T	0.46	0.34
15			0.02	0.89	0.03		0.01	
16		T						
17		0.01				T		
18		T		0.04		T		
19			0.43	0.14		T		
20			0.92			T		
21	T					1.13	2.27	
22	0.47		0.05	0.41	0.22	0.01	0.44	1.12
23			0.02	T			0.02	T
24						T	0.04	
25		0.09		0.02	T			T
26			0.98		T			
27				0.25				
28	T			0.05				
29		0.04		T		0.03	0.08	
30	0.02			0.04		0.12	0.38	
31				0.02			0.16	
Total	0.49	3.02	2.69	3.01	1.77	3.11	5.11	4.34
Normal	3.30	3.74	3.61	3.28	4.08	3.45	3.72	3.33

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REPORT OF THE DEPARTMENT OF ANIMAL HUSBANDRY

Department of Animal Husbandry

J. M. HUNTER, BSc., *Animal Husbandman.*

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Report of the Department of Animal Husbandry

J. M. Hunter

FEEDING EXPERIMENTS

In connection with a series of experiments on the free-choice self-fed method versus the hand-feeding of market pigs on forage crops, the Department of Animal Husbandry began a second trial on June 15, 1917, with 20 head of pigs and a third trial on July 25, with 30 head of pigs. This trial was completed in December, 1917. In the second trial corn, middlings and tankage made up the ration, as was the case in the summer of 1916, while in the third trial corn and tankage were used without wheat middlings. The animals were divided into lots of ten each and grown from an average of 45 pounds to a marketable weight of 200 pounds. The results of these trials thus far indicate that the self-feeder is a distinct advantage in the saving of labor and enabling pigs to make a 200-to 250-pound weight in a much shorter period of time. On the other hand, a summary of the trials to date shows that there is no appreciable amount of grain and other concentrates saved by one method over the other.

A third trial will be conducted this season (1918), checking the results of the two previous years.

During the past few years, and particularly since the beginning of the war, there have been many inquiries concerning the use of garbage as a feed for swine, and because of the immediate need for feed substitutes, as well as an increased meat supply, additional information as to the more efficient use of garbage as a feed for hogs has indeed become timely.

Through the cooperation of the animal husbandry department of the Experiment Station, the State Hospital at Trenton, N. J., and the United States Department of Agriculture, it was possible for the animal husbandman to outline a garbage feeding experiment to be conducted at the State Hospital piggery. The experiment was begun on June 7, 1918. Sixty pigs were fed on six different rations. It is planned to carry the various lots to an average marketable weight of 200 to 250 pounds each.

The spring forage crops have again been seeded, a combination of Dwarf Essex rape, 6 pounds, and white blossom sweet clover, 12 pounds per acre being used as the principle mixture for the experimental work and also for the young breeding stock which will be carried through the summer.

An experiment is being conducted with 2 3-10 acres of alfalfa seeded August 14, 1917. The purpose of the experiment is to determine, if possible, if alfalfa may be cut for hay three times during the first season and at the same time be utilized as a hog pasture.

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REPORT OF THE DEPARTMENT OF POULTRY HUSBANDRY

Department of Poultry Husbandry

HARRY R. LEWIS, M. AGR., *Poultry Husbandman.*
*WILLARD C. THOMPSON, B.SC., *Assistant Poultry Husbandman.*
RALSTON R. HANNAS, MSC., *Assistant in Poultry Research.*
MORRIS SIEGEL, *Poultry Foreman.*
ELMER H. WENE, *Supt. Vineland Contest.*

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* Given leave of absence to enter military service.

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Report of the Department of Poultry Husbandry

H. R. Lewis

The poultry husbandman is pleased to report continued progress in the various lines of experimental work during the past 8 months. In spite of the handicaps and hardships occasioned by conditions created by the world war, the poultry work has made considerable progress both at New Brunswick and at Vineland.

With the change in the beginning of the fiscal year from November first to July first issuing a report for the department at this time makes it impossible to report satisfactorily on the projects either now or in the future. The projects which are at present under way, for the current year, have been in duration for only 8 months, and hence have not progressed far enough to warrant analysis at this time. In the second place, and of far greater importance, the hen year begins on November first, and if an attempt is made to report the poultry activities as of July first, the reports must of necessity be eight months old when they are prepared and probably over a year old before they are published.

Administration

The poultry department staff has been subjected to many changes during the year due to the call for military service. A serious temporary loss has been occasioned by the leave of absence given Mr. Thompson for the duration of the war. His leaving has necessitated a considerable reorganization of the work. Mr. George H. Pound, a graduate of Cornell University, and for some years a practical farmer and poultryman in New Jersey, has recently been engaged to take over certain definite responsibilities in the department. It is an extremely hard problem to maintain necessary labor to carry on research projects and to care for the laying flocks. The salaries which are demanded by such men as can be secured are far in advance of such amounts as the budget will warrant. This means frequent replacing of such men, and general inaccuracy and inefficiency in the work, due to lack of experience. Mr. Wene has continued as superintendent of the Vineland contest, but the staff under him has been subjected to sudden changes during the year, in spite of which very remarkable success has attended his efforts there. The following is the make-up of the staff of the department of poultry husbandry as it exists at this writing.

Prof. H. R. Lewis, Poultry Husbandry.
V. G. Aubry, Extension Specialist.
R. R. Hannas, Assistant in Research.
George H. Pound, Poultry Assistant.
Morris Siegel, Foreman, Production Plant.
Dudley Cobb, Helper.
F. C. Corwin, Helper.
E. H. Stokes, Helper.
Antal Kiss, Helper.
Mary B. Reed, Stenographer.
Dorothy M. Crouch, Stenographer.
Louise Treffinger, Stenographer.
E. H. Wene, Superintendent Vineland contest.
Joseph Fox, Helper.
Melvin Cosh, Helper.
H. Ellenoff, Helper.
Faith R. Lewis, Clerk.

Sudden Changes Necessitated by the War

The sudden shortage of staple food-stuffs and the inability to obtain at any price during certain parts of last winter, certain staple grains used in experimental feeding, has made it necessary to curtail and, in fact annul all feeding projects. The feeding work which has been done has been in the nature of short-time tests. Projects devoted to the determination of the relative merits of certain concentrated feeds, have been promulgated and brought to the front hurriedly in an effort to find something moderately cheap to provide protein concentrates in laying rations during war time. As a result of these tests it may be said that there is yet to be found a substitute for meat scrap worthy of the name. Good growth and a satisfactory egg production can be secured only when the ration fed is sufficiently supplied with milk and green succulent forage, such as clover, alfalfa or sprouted oats, and meat scrap.

Some of the projects undertaken by the department in the past few years have been continued with the idea of holding over the stock for future expansion rather than with the idea of continuing the project in all its detail at this time. This is true of the strain test work, the egg shell color work, and the inheritance of fecundity project.

The commercial poultry flock project has been continued with no change and will be productive of valuable data at its conclusion next winter. The Experiment Station flock has been cut somewhat to conform with war conditions, and rigid culling has been practiced throughout the year with a result that a very satisfactory egg production has been secured and a corresponding saving has been made in feed requirements. Because of the shortage of labor in the department, no effort has been made to maintain the attractive appearance of the lawns and grounds about the poultry farm and buildings. The entire time of the limited and inexperienced labor, which has been available, has been needed in the actual handling of the flocks. Many of the breeding pens and houses used for laying stock have this spring and summer been used for rearing, and there was probably never a time when the Experiment Station maintained a better proportioned and well grown flock of vigorous pullets and cockerels than at present.

Because of a satisfactory production and relatively high prices, the department during the past eight months has made a very fair revenue. This has been accomplished only by a careful management of the experimental flocks and the immediate disposal of all salable products as soon as their need for experimental use was past. The following in a list of the monthly receipts:

November	$ 220.80
December	200.82
January	409.41
February	844.00
March	1,103.82
April	1,366.85
May,	986.84
June	402.98
Total	$5,517.52

Administration Activities

There was probably never a period when the administration activities of the department have been more insistent or extensive. This has been due, first, to the careful planning and constant activity necessary on the part of the poultry keepers in maintaining a sufficient supply of feeding stuffs and miscellaneous poultry supply on hand to carry on their work, and in the second place, to the uncertainty in securing the necessary labor supply. In addition to these two items much of the time of the poultry husbandman has been given to outside national organization problems, including those having to do with the American Association of Instructors and Investigators in Poultry Husbandry, and more especially in the last three months to the organization of the National War Emergency Poultry Federation. This latter organization is a federation of all phases of the poultry industry and is attempting to meet a long felt need in serving, promoting and developing the poultry industry during the period of the war. During the first annual convention of this federation, recently held in Chicago, the following policy and program for the year 1918, was unanimously adopted and the necessary machinery created to put it into execution.

Policy and Program of the National War Emergency Poultry Federation

The National War Emergency Poultry Federation, being a Federation of organizations and individuals representing poultry production and allied interests, created to meet a pressing war emergency, hereby adopts and will unitedly support a national policy, which shall promote, foster, improve and protect the poultry industry in the United States, and in particular to effect such results through the agencies of investigation, education, cooperation and legislation.

In aiming to accomplish this policy our program for the year 1918-19 is as follows:

1. To help win the war by uniting the poultry interests, fostering the industry and supporting the nation.
2. To enlist, for the Federation and in the fulfillment of its purposes and programs, the full and united support of every individual firm and corporation, association or other organization having to do with or interested in any branch of the great poultry industry.
3. To eliminate duplication of effort and studiously to avoid conflict with the activities of any organization, individual or governmental agency, in the accomplishment of the constructive and patriotic work we may later undertake.
4. To enlist and equip the American hen to fight the Kaiser through her ability to produce economically more meat and meat substitutes.
5. To formulate a sound, practical policy looking to the stimulation of poultry and egg production which shall secure to the producer fair remuneration for his efforts.
6. To educate the consuming public as to the food value of poultry and eggs and their proper use as every-day foods.
7. To assure those engaged in production that the increased per capita consumption of poultry and eggs from year to year is clear proof that this tendency will continue with reasonable profit to the producer under proper production methods and conditions.
8. To provide ways and means to assure producers that they will get feed, fuel and other necessary supplies, and to make known to the authorities at Washington and elsewhere that the meeting of these requirements is a national necessity, without which the industry will perish.
9. To assist actively in securing raw materials and manufactured products needed by the people in the various branches of our industry so as to prevent the stopping of those processes essential to and a part of the ducts in all markets, as we believe this to be a progressive step for fabric of our nation-wide business.
10. To encourage among producers modern business methods such as cost accounting and the adoption of approved scientific practices.
11. To help secure uniform, interchangeable standards for our products in all markets, as we believe this to be a progressive step for the welfare of all concerned.
12. To work diligently with the government agents and otherwise to secure and provide adequate transportation facilities for our products and at such rates and charges as shall be on an equitable basis compared with those applying to competitive products.
13. To appeal to bankers and other business men of this country for their help in properly safeguarding our billion-dollar industry which represents one-twelfth of our annual agricultural crop wealth.

14. To cooperate with all educational and publicity agencies, particularly the poultry and agricultural press in securing and giving wide publicity to all available information of vital importance to the poultry industry.

15. To inaugurate a nation-wide survey of our resources and to collect statistics which shall be classified and distributed with other data bearing upon the welfare of our business.

16. To correct abuses and prevent waste in any and all phases of our industry.

17. To initiate and secure the passage of such laws and regulations as will insure the economical production of the largest possible volume of poultry and eggs.

18. To lay plans promptly to restock war-torn Europe with poultry for breeding and commercial purposes when peace shall have been restored.

19. To set forth more clearly the true function of the exclusive breeding, in improving and spreading the best types of fowls for different sections of this country.

20. To aid in selecting a suitable date to be known as National Poultry and Egg Day when we aim especially to direct attention by all available methods to the value and desirability of poultry and eggs in our national dietary.

21. To cooperate with national, state and local government agents in all matters pertaining to our industry with the aim of maintaining continued high efficiency in their work.

A greater amount of time and attention from the various members of the department has of necessity been given to extension activities as a result of the many perplexing problems of production and the closer margin of profit under which poultry keepers of all classes must work. Consequently, their demands for help become more insistent and a constant effort has been made to reach these demands in every way possible through personal visitation, through lectures in especially affected communities and through literature, both scientific and popular, which has laid down principles under which poultry must be kept during such times of emergency. The following is a list of the "Hints to Poultrymen" which have been published during the past eight months.

Hints to Poultrymen 1916-17

Month	Title	Author
October	New Jersey Poultry Survey.	A. G. Waller.
November	The Cost of Egg Production.	H. R. Lewis
December	Winter Rations for Poultry.	W. C. Thompson.
January	Vineland Egg Laying and Breeding Contest, Record of the First Year's Performance.	H. R. Lewis.
February	Successful Incubation Practices in New Jersey: Embryo Mortality.	R. R. Hannas.
March	Home-Grown Feeds for the Poultry Flock.	H. R. Lewis.
April	Feeding and Care of the Brooder Chicks.	V. G. Aubry.
May	Possibilities of the Suburban Flock.	H. R. Lewis.
June	National War Emergency Poultry Federation.	H. R. Lewis.

Experimental Work

No effort will be made here to give data concerning experimental projects, because such records would require a large amount of labor and time to work up for the 8 months' period covered, and after the data were tabulated and analyzed, they would be of little value since the projects are designed for one year or more, and since they must start and stop on November first. If the annual report for 1919 is rendered on July first the poultry department will publish in this report a complete account of all projects carried on during the year November 1, 1917, to November 1, 1918. Such information will be older when published than under the previous arrangements, yet the report should be of much greater practical and scientific value.

Vineland Contest

The work at the Vineland contest during the past year has been among the most gratifying lines of effort in which the poultry department has been engaged. The hens at the contest have been going through their second year's production and they have made a remarkable performance, nearly equaling the production of their pullet year. The incubation and brooding work incidental to the production of pullets for the third year has been remarkably successful. Fifty-three per cent of all eggs set were hatched from all breeds throughout the entire hatching season, and of the resulting chicks hatched, over 85 per cent have been reared to market age. The chicks have made a remarkable growth, and this performance in large measure has been due to the use of sour skim-milk to drink, dried buttermilk in the mash and plenty of green alfafa on the range. Everything looks extremely promising for the most successful third year of the contest, because of the exceptional growth which the pullets are making. The problem of financing the contest has been very hard, and required exteremely careful planning, because the budget under which the contest is being run was drawn up and adopted in 1914, or before the influence of the war was understood. By judicious buying and careful marketing, it is hoped that the contest can be financed with no additional support than that originally planned. A full report for the first year will soon be published in bulletin form from the New Jersey Agricultural Experimental Station and will contain much valuable research data.

New Jersey's Poultry Industry as Affected by the War

It must be keenly appreciated by every poultry raiser that everything possible must be done to insure an ample food supply for this nation and our allies in order that we may satisfactorily prosecute the war. In order that this food supply may be assured, every type of agricultural enterprise must be carefully studied and tuned up to meet the extra demands made upon it. Not only must production be maintained and in many instances increased, but efficiency in production and the elimination of wasteful processes must be constantly emphasized and striven for. New Jersey must assume an especially important role in so far as the poultry production of the country is concerned. The poultry industry is one of New Jersey's leading agricultural enterprises, representing over 8 per cent of her agricultural wealth. Her farm flocks are more widely distributed, of larger size, and as a rule better cared for than similar flocks in most other sections. The city or suburban flocks are a peculiar adjunct of this industry, which contribute much to the total egg and poultry production. The commercial egg and breeding farms are among the largest and most efficiently operated in the country. Our poultry industry is a vital factor in supplying the "nearby" egg to the intensely populated sections of the eastern coast. While our poultry industry competes in an indirect way with the general farm flocks of the Mississippi Valley, yet in quality of output and in efficiency of production, there is no comparison. The nearby egg, marketed as soon as produced, reaches the consumer in a strictly fresh condition, resulting in a satisfactory price to the producer. It is doubtful if eggs can be produced more economically or efficiently on any type of farm in the country than on New Jersey's commercial egg farms where careful breeding and feeding and business-like methods of management are to be found. An efficient egg supply is ever becoming a greater and greater necessity, because of the growing demand for its use for hospital purposes. Our poultry industry must be developed, conserved and maintained to its utmost.

It will be the policy of the poultry department of the Agricultural Experiment Station, when working out a war program, to cooperate fully with existing organized poultry associations and other agricultural agencies. It will continue to foster and aid future organizations. There is no better organization of progressive poultrymen anywhere in America than we have right here in New Jersey, and this organization should make possible the proper development and maintenance of the industry even under the most exacting conditions created by the world war. The poultry grower of New Jersey must feel that his obligation to do his part in this national crisis is constantly present, and that he must do everything within his power in an effort to solve the perplexing problems concerning the industry in which he is engaged.

If the required amount of food is to be produced, it will be because the American farmer, together with his family, keeps faithfully at work toiling in a conscientious effort to do his part. The poultryman's hours must be long, his work more tiresome and his problem one of constant study and changing methods in management in order to conduct his business profitably. His willingness to do all that is needed of him will depend in large part upon his attitude, his state of mind, his belief that his interests are being safeguarded as much as it is possible to safeguard any productive agricultural enterprise, and the belief that his interests are not being wilfully sacrificed for the more immediate necessities of war such as ships, munitions and other supplies.

Every effort of the Food Administration and of the United States Department of Agriculture has been to encourage the farmer to greater productive efforts and this encouragement can and will materially hasten the results desired if security and safety are created about the business of food production. This can be done and no doubt will be by a limitation of rulings directly affecting production, by giving the producer representation in the councils of food control, and by assuring him that in the future no rulings will be made which will affect his business adversely, unless they are an absolute national necessity. Such a condition of affairs will result in an elimination of that psychological condition of fear which is present, and which if allowed to develop, can only result in a marked reduction in production. The Food Administration and the United States Department of Agriculture have a gigantic problem on their hands, a greater one than ever human skill and ingenuity have been asked to fathom. They have acquitted themselves in a marked and successful degree; and if a few minor mistakes have crept in, we are sure they will not be repeated, that everything possible will be done to stimulate and encourage production by safeguarding the producer's business and by providing him with necessities for production. There was never a time in the history of our country when constructive suggestions and criticisms designed to remedy existing defects were more needed. Let every poultry producer in New Jersey get back of this proposition and lend his influence in every way possible to creating such conditions that our industry cannot fail to meet the need of the hour.

While it is true that there must be greater and greater amounts of food produced, it is also true that greater food production will not be accomplished if conditions are not such as to make this production possible and profitable to the producer. Let us study, then, in a general way, some of the immediate factors which are affecting New Jersey's poultry industry. There are six definite groups of factors which have had a tendency to work hardship to the poultryman, tending to curtail production. These factors are:

1. Feed	Scarcity which at times reached total absence. Continued high prices.
2. Hard Season for Poultry	Adverse weather. Low production.
3. Transportation Difficulties	Delay, loss embargoes. Frozen eggs, breakage.

4. Coal Shortage	For Incubation and brooding.
5. Present egg prices	As compared with increased cost factors, seem unfair and unprofitable.
6. Questions as to the Future	Government regulations. Egg and meat prices. Feed supply.

While the prices of poultry feeding stuffs are relatively high, yet the poultryman should appreciate that they must continue to be high if the farmer producing grains is to receive sufficient compensation for his time and labor that will continue to stimulate him to increased production. We hear very few poultrymen questioning the price. The hard problem and the most discouraging one seems to be the scarcity. This condition has been created in large part by transportation difficulties and by the immense demands upon our normal supply for export to Europe. There is real evidence at hand to show that this scarcity is rapidly being overcome and that there is every possibility that the poultryman will continue to receive sufficient supplies of the necessary feeding stuffs with which to keep his flocks in a producing condition. There is no question but that the hard winter, combined with the increased cost of production, has been a discouraging factor, and has tended to keep profits below the point which they should reach in order to make the business attractive. The winter is now over, and summer is here, and we can look ahead with encouragement for much more congenial surroundings and environmental conditions than the past winter has had in store.

Another general disturbance to the industry has been the serious transportation problem during the past winter. The great amount of material which the express companies have had to handle has caused delays and embargoes, resulting in large losses, excessive numbers of frozen eggs and much breakage. The general shortage of coal throughout the early spring, and in some sections even at this writing, has retarded brooding and has been a contributing cause in the restricted number of chicks which will be hatched. In some sections, cooperative effort has resulted in overcoming this shortage, but in others it has been a very serious problem and almost impossible of solution.

The current price of eggs which, it is felt by many, has not kept pace with the increased cost of production, is another contributing factor to the present uneasiness. There are just two solutions of this problem. One is to assure the producer of such prices as will provide him with a fair profit over the costs of production, and there is no question but that this should be done. The second solution lies with the producer himself; he must work out such practices as will reduce the cost of production, in so far as such reduction can be made possible, by more efficient practices.

Another problem which is ever before the mind of the producer is the question as to what the future holds in store. What prices will be realized for his products? To what points will feed costs and labor charges advance? And lastly, what government regulations will be promulgated, and what will be their effect upon his business? In regard to this last point we must all appreciate that the various administrators having to do with production, conservation and distribution, are doing all in their power to stimulate production, and it is their purpose to issue no ruling which will in any way work a hardship upon the producer, unless it is an absolute war necessity, under which circumstances we must each bear our burden of the costs.

The effects of these adverse factors have been very pronounced. In the first place, there is no question but that they have resulted in a decrease in the number of hens during the past year, of opproximately 20 per cent. There was also a marked decrease in the number of chicks hatched this spring, probably ranging from 30 to 50 per cent. The ultimate effect of this will surely be a decreased egg production in New Jersey and a decrease in the amount of poultry meat produced. There are certain aspects of this situation which should be appreciated. In the first place, this reduction has taken place primarily in small flocks among the amateurs and among men who have recently started in the business, who because of lack of experience, have been affected the most adversely. A normal reduction of the number of fowls, if this reduction is a result of intelligent culling, is no doubt an efficiency measure which should be encouraged. It is certainly not economical, nor is it patriotic, to feed to cull birds or non-productive hens, grains at the present prices, which in turn are so seriously needed for human consumption. On the other hand, it is not economical or patriotic for a poultry keeper with a rather small flock which cannot be operated profitably, because it is being operated against certain economic principles, to continue to spend his time caring for these birds. It is better, under these circumstances, that this flock should be disposed of and that the person's time be spent more efficiently in some other line of productive effort. There are four fundamental factors which regulate and restrict the profits to the poultry keeper. They are:

1. Amount of production per bird.
2. Size of the flock.
3. Amount of capital invested.
4. Experience of the operator.

These factors mean that if a poultry keeper has not a flock from which he can secure a good egg production, or if he has not sufficient capital for operating his plant advantageously, or if he has not sufficient experience to meet the perplexing problems of today, he cannot expect to make of his poultry venture a financial success. It is better for himself and for the immediate needs of the country that his time be more efficiently utilized. On the other hand, a poultryman who is able to meet these four factors in the proper degree should by all means strive to develop his business in as successful a way as possible; and while he will no doubt be able to hold on and to make a satisfactory living under war conditions, during the reconstruction period after the war the demand for poultry stock and poultry products of all kinds will be so great and offer such attractive profits that this type of poultryman will reap the benefits of his patience and present sacrifice.

Program of the Poultry Department for 1918

The poultry program is two-fold:

First, to keep thoroughly informed of existing conditions by studying, with every possible means, the constant and ever-changing factors affecting the industry and to determine the reaction of such conditions upon poultry production.

Second, to stimulate in every possible way a greater efficiency in poultry production, and to strive, in so far as is consistent with costs and revenue factors, to maintain production.

Every problem undertaken, and every recommendation made will have for its ultimate object and aim the making of our poultry industry permanently sound, both economically and financially, in order that we may better evolve our obligation to provide human food during the remainder of the war, and in order that the poultry industry of the East, the home of standard-bred poultry, may be in a position to come to the rescue in supplying stock with which to rehabilitate the depleted flocks of Europe and America.

Our Part of this Program

First, to study existing conditions in the following ways:

Poultry questionaires.
Projects.
Crop reports.
Market receipts.
Surveys to determine changing costs facts.
Vineland Egg Laying Contest.
Constant observation and visitation.

Second, to secure efficiency in, and to encourage maintenance of production by recommending the following practices:

Rigid and continuous culling.	A.	Eliminate boarder hens.
	B.	Conserve producing hens.
	C.	Select breeders carefully.
Meeting the Feed Problem.	A.	Substitute for wheat and its by-products, corn, oats, gluten, oil meal, meat, fish, milk or milk substitutes, depending on price and supply. Use locally-grown cereals more generally.

	B. Conditions necessitate the extended use of standard ready-mixed feeds. C. Feed proper amounts, twice as much mash as grain to all laying flocks. D. Prevent waste.
Growing at home more of the poultry feeds.	A. Mangel beets for succulence. B. Alfalfa. C. Cereals for grain and litter. D. Corn. Conserve and use poultry manure to grow these crops. Reinforce with acid phosphate, gathering frequently and storing properly.
Practice early hatching.	A. Avoid hatching any chicks after June 1.
Rear young stock properly.	A. Plenty of range. B. Plenty of mash feed.
We must have more home flocks.	A. More city and suburban flocks. B. More, larger and better farm flocks. C. Poultry clubs and contests for school children.
Home preservation of eggs in water-glass.	
Greater care in, and better methods of management.	
Improved conditions through cooperations with the New Jersey State Poultry Association and with local community centers.	A. Buying. B. Selling. C. Education.

Poultry keeping is a business and must be run as a business. Success comes to him who can buy and sell right.

It will be the purpose and aim of the poultry department to emphasize the above factors which are brought out in this program by every means in our power. The more prominent methods will be as follows:

A. The publication of these facts in bulletins, circulars, newspapers, articles and press notices.

B. Correspondence with growers relative to their problems.

C. Delivering addresses throughout the state before poultry associations, granges and other interested organizations.

D. Visiting growers to determine and discuss local problems and return visits on the part of poultrymen to inspect the college plant and our methods of meeting these problems commercially.

E. The staging of educational exhibits to emphasize efficiency factors.

F. Planning and supervising demonstration projects in every county to show the working out of these problems and factors.

G. Promoting organizations of poultry producers and the encouragement of greater cooperative activity.

H. Encouraging the increase in the number of poultry keepers in cities and on farms and by getting our boys and girls actively at work through poultry clubs and organizations.

I. A continuation of the commercial and practical experiments at the Experiment Station plant and at Vineland to determine more efficient practices and to work out existing problems.

Your Part in this Program

This program cannot attain its purpose or cannot be properly evolved or worked out unless every poultry keeper in the state cooperates to the best of his efforts. Will not each poultry raiser, large or small, from the city or the country, do his part in the following way?

Notify us frankly of conditions as they affect your business, either favorably or adversely. Never be afraid to picture things as they are.

Make your discussions and comments constructive and not destructive, which have for their object a greater efficiency in production. If conscientiously followed, they cannot but help to maintain production and to insure a satisfactory return and profit to the poultry keeper as well as contribute materially to the food supply of our country.

Conclusion

In conclusion it may be said that our aims and purposes in administering the forces of the poultry department for the past 8 months have been and no doubt will continue to be during the ensuing year, to help win the war by uniting the poultry interests of the state, by fostering the industry through proper council and advice, and through the closest attention to these efforts to support the nation through the production of an adequate supply of poultry and eggs.

REPORT OF THE DEPARTMENT OF DAIRY HUSBANDRY

Department of Dairy Husbandry

William M. Regan, A.M., *Dairy Husbandman.*
Willes B. Combs, A.M., *Assistant Dairy Husbandman.*

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Report of the Department of Dairy Husbandry

WILLIAM M. REGAN

The activities of the department of dairy husbandry for the nine months ending June 30, 1918, may be listed as follows:

1. *Experimental*—Data have been gathered on two different experimental projects.

2. *Extension*—The department of dairy husbandry, cooperating with the division of extension, has given advice and assistance to the dairymen of the state through meetings, correspondence, and personal visits. Seven separate projects have been carried on, with 322 cooperators.

3. *Advanced Registry*—The advanced registry work of the state has been supervised by this department. An average of 266 cows were tested each month during the past nine months.

4. *Glassware and Tester's License Law*—The examination of all applicants for testers' license and the testing for accuracy of all glassware used in the purchase of milk and cream in New Jersey, has been supervised by this department.

DAIRY INVESTIGATIONS

Data have been taken during the past eight months on two major experimental projects, as follows:

1. *The relation of the conformation of dairy heifers to future production*—This experiment has been in progress for two years. More than 75,000 skeletal measurements, together with monthly body weights, have been taken on 250 animals. The body weight and twenty-five skeletal measurements are taken on each of the animals each month from birth until the end of the first lactation period. Some of the older heifers will freshen this fall. No conclusions can be drawn until another year's data have been taken.

2. *The milking machine and its relation to sanitary milk production*—For the past nine months data have been collected in a study of the relation of the milking machine to sanitary milk production. Sediment tests have been made daily and bacterial counts at regular intervals. Two makes of milking machines have been used, and an attempt is now being made to detect within the machine the most possible sources of contamination. All parts which come in contact with the milk are being examined separately to determine, in a degree, the care which should be given these parts for the production of a low-count milk.

EXTENSION WORK

There has been an unusual call this past year for dairy extension work. The dairy department and the division of extension have cooperated in giving advice and assistance to the dairymen of the state. This has been accomplished through the cooperative dairy projects, correspondence, personal visits and Farmers' Institutes. Much interest has been shown on the part of the dairymen in the reorganization of the State Dairymen's Association. A board of directors representing the dairymen in each dairy county is doing good work.

Seven committees, as follows, have been appointed from the members of the board of directors, with a member of the executive committee as chairman of each: Marketing, State Fair and Farmers' Week, Publicity, Organization, Finances, College and Extension Work, and Dairy Legislation.

Following is a list of the projects and the work that is being done under each.

1. Dairy Record Associations

Our eight associations have passed through the year and one new association has been organized as follows:

	Number of Members	Number of Cows
Bergen County Association Secretary, H. A. Davidson, Ramsey, N. J.	11	280
Mercer County Association Secretary, W. G. Oldis, Pennington, N. J.	25	460
Burlington County Association Secretary, John V. Bishop, Columbus, N. J.	6	300
Cumberland County Association Secretary, Walter Shute, Bridgeton, N. J.	12	200
Salem County Association Secretary, A. B. Waddington, Woodstown, N. J.	23	564
Sussex County Association Secretary, W. F. Whittemore, Newton, N. J.	23	586
Wallkill Valley Association Secretary, J. S. Katzenstein, Hamburg, N. J.	20	540
Middlesex-Somerset County Association Secretary, H. W. Klein, New Brunswick, N. J., R. F. D.	22	480
Warren County Association (formed May 1, 1918) Secretary, William Johnson, Hackettstown, N. J.	13	310

2. Mixing and Feeding a Home-Mixed Calf Meal

30 cooperators.

3. Dairy Record and Feeding Demonstrations

12 cooperators.

4. Soiling Systems as a Supplement for Pastures

3 cooperators.

5. Study of the Cost of Milk Production

100 cooperators

6. Dairy Herd Improvement at State Institutions

8 cooperators.

7. Boys' and Girls' Calf Clubs

4 clubs and 51 cooperators.

ADVANCED REGISTRY

The confidence of the breeders of pure-bred dairy cattle in the future of the dairy industry, after the war, is shown by the amount of advanced registry work done during the past winter. There has been an increase in the number of breeders doing semi-official work, in spite of high-priced feeds and scarcity of labor. The amount of work done in supervising advanced registry tests November 1, 1917, to June 30. 1918, is shown by the following table:

Cows Tested Semi-Officially:

Jersey	140
Guernsey	61
Ayrshire	30
Shorthorn	3
Holstein	24
Total	258

Number of semi-official tests, 1154.

Seven-day records	106
Fourteen-day records	2
Thirty-day records	12
Sixty-day records	1
Number of breeders doing semi-official testing	33
Number of breeders doing official testing	19
Total number of breeders doing testing	32
Number of supervisors used for official tests	12
Number of supervisors used for semi-official tests	31

GLASSWARE AND TESTERS' LICENSE LAW

Sixty-four creameries and milk plants in the state are using Babcock glassware that has been tested for accuracy by this department. Twenty-three certificates of efficiency have been issued to testers. Six of these have been renewals of licenses that were issued last year. The following is a summary of the glassware tested:

Description	Number of pieces tested	Per cent incorrect
Whole milk bottles	1733	3.8
Cream test bottles	103	9.7
Pipettes	49	0.0
Total	1985	3.87

Since the close of the last fiscal year, 97 samples of milk have been tested for butterfat by this department for dairymen of the state.

THE DAIRY HERD AND EQUIPMENT

The dairy herd on June 30, 1918, consisted of 102 animals, representing the four dairy breeds, and the milking shorthorns. Seventy-four of these are pure-bred animals.

During the year the following men have presented animals to the Experiment Station.

James Neilson, New Brunswick, N. J.,—8 grade Holstein cows, 5 grade Holstein heifers, and 1 pure-bred Holstein bull.

James Turner, Lusscroft Farm, Sussex, N. J.—1 pure-bred Jersey cow and 1 pure-bred Jersey bull.

L. F. Loree, West Orange, N. J.—2 pure-bred Guernsey bulls.

In addition to these animals, the Experiment Station has purchased 4 pure-bred Ayrshire cows and 2 heifer calves from the G. B. Schley Estate, at Far Hills, N. J.

Two pure-bred Holstein bulls have been loaned on cooperative breeding projects.

REPORT OF THE DEPARTMENT OF SEED ANALYSIS

Department of Seed Analysis

JOHN P. HELYAR, M.SC., *Seed Analyst.*
JESSIE G. FISKE, PH.B., *Assistant Seed Analyst.*

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Report of the Department of Seed Analysis

J. P. Helyar

Unusual conditions confronting crop producers with respect to seeds and other factors affecting production, and nation-wide publicity in connection therewith, have had their effect on the State Seed Laboratory. This has been expressed in unprecedented demands for analytical service and specific information concerning seed quality. The present circumstances have aroused a searching interest in the matter of seeds as related to crop production, and probably more has been accomplished along this line than could otherwise be expected, even after several years of continuous attempts through ordinary channels of publicity and education. Every possible effort should and will be made to maintain and increase the interest thus aroused.

It is believed that the service which this department was able to render in connection with the seed corn situation of the present season has done much to place the stamp of necessity upon the State Seed Laboratory, and to place the fact of its existence and functions in a definite manner before the public. It is not unreasonable to expect a continued and increasing development of this department of the Experiment Station, and lack of funds should not be a factor in retarding necessary developments. In meeting the present situation as well as in the normal work of the laboratory, the state seed analyst commends the faithful and efficient service rendered by members of the staff.

ANALYSIS OF UNOFFICIAL SAMPLES

Samples received from farmers, merchants, and others are classified as unofficial. These samples represent many lots of seeds which are sold, purchased, sown or rejected on the basis of laboratory reports. In quality they vary between wide extremes. In general, however, they represent fair quality, as some of the averages given will indicate. The kind, number and average quality of these samples is expressed in tables 1 and 2.

Table 1

Summary of Tests for Field Crop Seeds

KIND OF SEED	Total Number of Samples Received	Number of Purity Tests Made	Number of Germination Tests Made	Average Per cent. Purity Found	Average Per cent. Germination Found
Timothy	38	36	38	99.3	93.7
Redtop (Fancy)	8	8	8	91.6	85.2
Redtop (Chaffy)	4	4	4	64.5	68.1
Kentucky Blue Grass	9	9	8	71.5	
Canada Blue Grass,	5	5	5	86.0	83.4
Orchard Grass	11	11	10	64.3	52.3
Meadow Fescue	2	2	1	96.5	72.5
Red Fescue	8	7	8	93.7	35.4
Crested Dog's Tail	3	3	3	81.0	19.5
English Rye Grass	3	3	3	97.8	62.2
Miscellaneous Grasses	5	4	5	....	....
Lawn Grass Mixtures	8	8	2	67.5	....
Millets	16	15	16	97.7	97.7
Barley	2	..	2	....	95.5
Field Corn	379	..	379	....	72.4
Oats	7	..	7	....	95.0
Buckwheat	4	..	4	....	97.0
Rape	2	..	2	....	83.5
Red Clover,	59	52	59	98.1	86.3
Alsike Clover	30	30	26	96.9	80.0
Crimson Clover	26	26	24	96.2	76.9
White Clover	8	7	8	94.0	72.8
Sweet Clover	8	7	8	97.9	68.3
Alfalfa	72	72	67	98.9	78.6
Winter Vetch	16	10	16	99.0	70.5
Soybeans	8	..	8	....	78.6
Cowpeas	3	..	3	....	85.0
Canada Field Peas	4	..	4	....	91.5
Miscellaneous Mixtures	3	1	3	....	....
Total	757	320	728		

Table 2

Summary of Tests for Vegetable Seeds

Kind of Seed	No. of Samples	Average per cent Germination
Asparagus	4	62.3
Beans	121	80.2
Beets	68	59.8*
Brussels Sprouts	2	93.3
Cabbage	45	69.7
Cantaloupe	14	87.4
Carrot	36	61.8
Celery	35	54.2
Sweet Corn	45	68.8
Corn Salad	5	30.5
Cress	3	64.0
Cucumber	25	72.4
Egg Plant	3	67.0
Endive	4	43.6
Kale	5	82.0
Kohl Rabi	3	68.0
Leeks	3	45.7
Lettuce	43	44.6
Okra	9	63.2
Onion	40	73.7
Parsley	16	45.3
Parsnips,	10	47.0
Peas	65	81.3
Pepper	40	65.9
Pumpkin	5	81.8
Radish	50	76.9
Rhubarb	2	80.7
Salsify	3	90.7
Spinach	30	56.3
Squash	17	53.9
Tomato	55	87.1
Turnip	29	66.5
Watermelon	14	63.9
Miscellaneous Samples	20	....
	869	

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* 111.3 sprouts per 100 seed balls.

SEED CORN TESTS

The Seed Laboratory recognized early in the year that decided action was necessary to prevent serious losses from the use of poor seed corn. The advent of extremely cold weather early in the winter, and before most of the corn was thoroughly dried, killed or weakened much of the corn that would have been used for seed unless particular attention was called to this condition and the need for testing emphasized.

News items and mailing cards were prepared which stated the probable condition. Through the county farm demonstrators and others, ear samples were secured from a number of farmers in each of several counties, in order that the general condition of seed corn might be studied and recommendations made according to the facts of such study. The amount of testing work done in this connection is shown in table 3.

Table 3

Summary of Tests of Seed Corn

County.	No. of Lots.	Total Number of Ears.	Number of Composite Samples.
Atlantic	1	25	..
Burlington	15	218	7
Camden	21	386	4
Cape May	2	75	..
Cumberland	9	151	2
Essex	..	..	5
Gloucester	5	48	..
Hunterdon	26	369	7
Mercer	31	620	9
Middlesex	34	622	6
Monmouth	24	254	..
Morris	43	517	21
Ocean	1	40	..
Passaic	13	170	2
Somerset	50	1750	7
Sussex	16	334	3
Union	5	125	..
Warren	8	177	2
	304	5881	75

From the beginning the results indicated a serious condition and every effort was made to meet the situation with adequate measures. Information relative to apparent conditions in each county was sent out through the county farm demonstrator. For 105 lots totalling 1680 ear samples, the average total germination was found to be only 73 per cent, the average proportion of strong sprouts 32 per cent, and the average proportion of ears showing one-sixth or more dead seeds was 47 per cent.

To secure the most effective results in testing seed corn throughout the state, some community testing centers were established and many schools took up the work in a limited way, the latter primarily attempting nothing more than a demonstration of the conditions said to exist. For the community and school work, several thousand copies of special instructions for sampling and testing, and blanks for recording results were prepared by the state seed analyst and distributed through the county farm demonstrators and school officials.

The testing work performed by the State Seed Laboratory also enabled it to gather information concerning available seed corn of good quality as judged by the samples submitted. A special survey was made which resulted in the listing of about 5,000 bushels of seed corn. Copies of this list were made available to the county demonstrators and others interested in sources of seed corn.

INSPECTION AND ANALYSIS OF OFFICIAL SAMPLES

Inspection of dealers' stock has been much more limited than is desirable for effective operation of the seed law. Thus far only a limited number of samples has been secured. Arrangements have been effected whereby the inspectors will be able to cover the assigned territory more efficiently. It is hoped that stocks of crimson clover, alfalfa, red clover and timothy which will be sold in July and August can be sampled extensively.

Of the official samples analyzed, a number are manifestly inaccurately labelled. Offending dealers have been advised and settlement is pending. One wholesale dealer in particular seems to be continuing the practice of supplying inaccurate labels, but not without some sacrifice of business, as correspondence from certain dealers indicates. Prosecution should be the last resort in most cases, but it may be necessary for the desired effect. However, it should be undertaken only in circumstances where the outcome can be very certain. One such case, and especially the first one, if lost to the state will have a decidedly nullifying effect in future cases.

Inspectors also report the finding of unlabelled stocks of seed. This condition is not to be unexpected and in consequence, may not be as harmful to agricultural interests as falsely labelled seeds. The more extensive the inspection can be made, and the more insistent the demand of the purchaser, the sooner we shall obtain the condition demanded by the law. It involves both increased appropriation and extension of educational measures to both dealer and purchaser.

Although the fiscal year terminates June 30, it will be advisable to delay publication of the results of the seed inspection and analysis until later in the year. Present publication would mean splitting the records of a season which it is believed would be a disadvantage in many respects.

REPORT OF THE DIVISION OF EXTENSION IN AGRICULTURE AND HOME ECONOMICS

Division of Extension in Agriculture and Home Economics Staff

Alva Agee, M.Sc., Director.
Frank App, B.Sc., Acting State Leader of Farm Demonstration.
Victor G. Aubry, B.Sc., Extension Specialist in Poultry Husbandry.
John W. Bartlett, B.Sc., Extension Specialist in Dairy Husbandry.
Bertha Cold, B.Sc., Home Demonstration Agent for Jersey City.
Roscoe W. DeBaun, B.Sc., Extension Specialist in Market Gardening.
J. B. R. Dickey, B.Sc., Extension Specialist in Soils and Agronomy.
Marjory A. Eells, Home Demonstration Agent.
Edna Gulick, Home Demonstration Agent.
William H. Hamilton, B.Sc., Assistant State Leader of Farm Demonstration.
Margaret H. Hartnett, Home Demonstration Agent for Paterson.
M. Anna Hauser, B.Sc., State Home Demonstration Leader.
A. M. Hulbert, State Leader of Boys' and Girls' Club Work.
M. Ethel Jones, B.Sc., M.A., Assistant State Club Leader.
May Dunkin Kemp, B.Sc., Home Demonstration Agent for the Oranges.
William F. Knowles, A.B., Assistant State Club Leader.
Van E. Leavitt, Extension Specialist in Fruit Growing.
William M. McIntyre, Assistant Extension Specialist in Fruit Growing.
Helen E. Minch, Assistant Home Demonstration Leader.
Charles H. Nissley, B.Sc., Extension Specialist in Market Gardening.
Adelia Fern Noble, Home Demonstration Agent for Princeton.
Ethel H. Osmond, B.Sc., Home Demonstration Agent.
Lena R. Pierce, B.Sc., Home Demonstration Agent for Trenton.
Regine Porges, B.Sc., Home Demonstration Agent for Passaic.
Caroline R. Simons, Home Demonstration Agent for Camden.
Norine Webster, Home Demonstration Agent for Bayonne.
Carl R. Woodward, B.Sc., Editor.

Frank A. Carroll, Demonstrator for Mercer County.
Elwood L. Chase, B.Sc., Demonstration Agent for Gloucester County.
Louis A. Cooley, B.Sc., Demonstration Agent for Ocean County.
Herbert R. Cox, M.S.A., Demonstration Agent for Camden County.
Josephine C. Cramer, B.Sc., Home Demonstration Agent for Middlesex County.
Lee W. Crittenden, B.Sc., Demonstrator for Middlesex County.
Ellwood Douglass, Demonstrator for Monmouth County.
Arden M. Ellis, Assistant Demonstration Agent for Monmouth County.
Irvin T. Francis, A.B., Demonstration Agent for Essex County.
Harry C. Haines, Demonstration Agent for Somerset County.
Cora A. Hoffman, B.Sc., Home Demonstration Agent for Morris County.
William A Houston, Assistant Demonstration Agent for Sussex County.
Lauretta P. James, B.Sc., Home Demonstration Agent for Mercer County.
Philip F. Keil, Demonstration Agent for Burlington County.
H. S. Lippincott, B.Agr., Demonstrator for Morris County.
L. F. Merrill, B.Sc., Demonstrator for Bergen County.
Warren W. Oley, BSc., Demonstrator for Cumberland County.
J. A. Stackhouse, B.Sc., Demonstrator for Cape May County.
Eunice Straw, B. Sc., Home Demonstration Agent for Monmouth County.
Harold E. Wettyen, B.Sc., Demonstration Agent for Passaic County.
Carolyn F. Wetzel, Home Demonstration Agent for Bergen County.
A. E. Wilkinson, M.Agr., Demonstration Agent for Atlantic County

Report of
Division of Extension in Agriculture and Home Economics

For the Period of Eight Months, Ending June 30, 1918

REPORT OF THE DIRECTOR

ALVA AGEE

As the fiscal year in New Jersey formerly ended October 31st, previous reports have covered periods of twelve months, ending with that date and the change in the State's fiscal year, causing it to correspond with the national fiscal year, compels a report in midsummer, when the season's undertakings are only well under way. The period covered by this report is eight months.

Emergency war work interfered seriously with the regular educational work of specialists and county farm demonstrators. Only one thing really counts today, and that is the winning of the war. The members of our staff have neglected their educational projects only so far as immediate necessities required. The policy has been to maintain the leading ones, but the urgent calls of the national government for service have not been neglected.

The reports of leaders in county farm demonstration, home demonstration, boys' and girls' club work and the reports of specialists are submitted with a considerable degree of pride. The thorough organization of county farm demonstration is due largely to Mr. John H. Hankinson, who resigned from the state leadership May 1st and our thanks are due to Professor Frank App, head of the department of agronomy in the college, who most kindly became acting state leader and served most efficiently until the close of the fiscal year.

The home demonstration work has been well organized by its state leader, and is especially serviceable under the present war conditions.

The state club work has been put upon an especially satisfactory basis by its state leader.

Our farm demonstration work manned by a staff of earnest, efficient men, owes much to the specialists connected with the central office.

Probably the outstanding fact in the eight months' experience is the development of community interest and team work in our various counties, with the assistance of capable farm demonstrators, that is helping in a practical way to win the war. The extension staff has worked as a unit in a most gratifying degree.

CHANGES IN AGRICULTURAL EXTENSION STAFF

APPOINTMENTS

1917.

Nov. 1. Elwood L. Chase, Demonstration Agent for Gloucester County.
Nov. 1. William A. Houston, Assistant Demonstration Agent for Sussex County.
Nov. 5. Clara P. Forte, Home Demonstration Agent for Burlington County.
Nov. 16. Harold E. Wettyen, Demonstration Agent for Passaic County.
Dec. 1. Walter C. Vail, Demonstration Agent for Salem County.
Dec. 17. Ruth Wallis, Home Demonstration Agent for Perth Amboy.

1918.

Jan. 1. Eleanor K. Johnston, Home Demonstration Agent for Elizabeth.
Jan. 1. Caroline R. Simons, Home Demonstration Agent for Camden.
Jan. 1. Louisa Vanuxen, Home Demonstration Agent for Newark.
Jan. 15. Edna Gulick, Home Demonstration Agent.
Jan. 16. Sara T. Jackson, Assistant State Club Leader.
Feb. 1. Margaret M. Cornell, Home Demonstration Agent for Trenton.
Feb. 1. Marjory A. Eells, Home Demonstration Agent.
Feb. 1. Bertha Cold, Home Demonstration Agent for Jersey City.
Feb. 7. Philip F. Keil, Demonstration Agent for Burlington County.
Feb. 18 William F. Knowles, Assistant State Club Leader.
Feb. 25. William M. McIntyre, Assistant Specialist in Fruit Growing.
Mar. 15. Helen E. Minch, Assistant Home Demonstration Leader.
Mar. 20. Lee W. Crittenden, Demonstrator for Middlesex County.
Apr. 1. Albert E. Wilkinson, Demonstration Agent for Atlantic County.
May 1. Robert Poultney, Assistant Specialist in Dairy Husbandry.
May 1. Frank App, Acting State Leader of Farm Demonstration.
May 1. Adelia Fern Noble, Home Demonstration Agent for Princeton.
May 16. Arden M. Ellis, Assistant Demonstration Agent for Monmouth County.
May 16. Lena R. Pierce, Home Demonstration Agent for Trenton.
June 1. Ethel H. Osmond, Home Demonstration Agent.
June 10. Irvin T. Francis, Demonstration Agent for Essex County.
June 10. Norine Webster, Demonstration Agent for Bayonne.

The above appointments in the Extension Staff were made from November 1, 1917, to June 30, 1918. The following have been made since July 1:

July 1. Van E. Leavitt, Extension Specialist in Fruit Growing.

July 16. Cora A. Hoffman, Home Demonstration Agent for Morris County.
July 16. May D. Kemp, Home Demonstration Agent for Orange, East Orange, South Orange and West Orange.

RESIGNATIONS.

1917.
Nov. 24. Mabel A. Tallant, Home Demonstration Agent for Sussex County.
Nov. 30. Allen G. Waller, Assistant Extension Specialist in Agronomy.
1918.
Jan. 31. George T. Reid, Demonstrator for Burlington County.
Feb. 9. Charles Orchard Smith, Assistant State Club Leader.
Feb. 26. Nelle Johnson, Assistant Home Demonstration Leader.
Feb. 28. Albert Schaffle, Demonstration Agent for Atlantic County.
Mar. 15. Helen E. Minch, Extension Specialist in Home Economics.
Mar. 31. Irving L. Owen, Demonstrator for Middlesex County.
Apr. 15. Eleanor K. Johnston, Home Demonstration Agent for Elizabeth.
Apr. 15. Ruth Wallis, Home Demonstration Agent for Perth Amboy.
Apr. 24. Clara P. Forte, Home Demonstration Agent for Burlington County.
Apr. 30. John H. Hankinson, State Leader of Farm Demonstration.
Apr. 30. Margaret C. Hayes, Home Demonstration Agent for Morris County.
May 15. Margaret M. Cornell, Home Demonstration Agent for Trenton.
May 31. Robert Poultney, Assistant Extension Specialist in Dairy Husbandry.
June 30. Sara T. Jackson, Assistant State Club Leader.
June 30. William B. Duryee, Specialist in Farm Management.
June 30. Harriot Ware, Home Demonstration Agent for Bayonne.
June 30. Paul B. Bennetch, Demonstrator for Sussex County.
June 30. Walter C. Vail, Demonstration Agent for Salem County.

The following resignation has been made since July 1, 1918:

July 15. Louisa Vanuxem, Home Demonstration Agent for Newark.

PUBLICATIONS

Bulletins

No. 13, Nov., 1917. Director's Annual Report. 94p.
No. 14, Nov., 1917. Care and Use of Farm Manure. 16p.
No. 15, Dec., 1917. Home Canning and Curing of Meat. 11p.
No. 16, Dec., 1917. Boys' and Girls' Club Work in New Jersey. 19p.
No. 17, Dec., 1917. Breads. 7p.
No. 18, Dec., 1917. Farm Labor. 31p.

News Letters

Vol 5, No. 1, to Vol. 5, No. 35.

Farm Demonstration Exchange

Vol. 4, No. 1, to Vol. 4, No. 5.

In order to help meet the large demand for publications, the following circulars were printed by the State Department of Agriculture, with proper credit to the extension staff:

Circulars

No. 16. The Home Vegetable Garden.
No. 17. Boys' and Girls' Garden Clubs.
No. 18. Potato Recipes.

REPORT OF FARM DEMONSTRATION WORK

Frank App, *Acting State Leader*

William H. Hamilton, *Assistant State Leader*

Since this report covers the period from November 1, 1917, to June 30, 1918, and is made in the midst of the season, it is not possible to give definite results of the field demonstration work which was planned during the winter and is now under way. Consequently, as far as field tests and demonstrations are concerned, this must be a report simply of progress. However, definite results can now be reported concerning work along organization lines, winter meetings, and the development of plans for the year. The work is reported under the various project headings and by counties.

Organization and Relationship of County Boards of Agriculture

County boards of agriculture are the local partners of the State College of Agriculture and Experiment Station in developing and carrying out farm demonstration work in their respective counties. During the winter county boards of agriculture have come to a better understanding of this relationship and have assumed a greater responsibility for the success of farm demonstration work in their counties. Great progress has been made in the organization of county boards of agriculture on the community plan, which has been in operation only a little over one and one-half years.

During the winter 229 community committees have been formed in the state. This places a committee in practically every organized community in the organized counties. For the most part these committees have been elected by the farmers in their communities and are made up of the best farmers in the communities. These committees are proving their value in bringing a better understanding of county agent work to the people of their communities and in spreading the results of demonstrations that have been conducted. Through these committees the farmers are learning the value and advantage of co-operation with each other and with county agents and state institutions in working out the solution of their problems. During the winter the membership in county boards of agriculture has been increased approximately from 2500 to over 7500 in the organized counties.

The county board of agriculture has come to stand as the farmers' organization, coordinating in a large degree all organizations within the county interested in agriculture. It has been recognized by the State Council of Defense, which has added to their township committees members of the community committees, giving these members charge of the agricultural work of the organization.

During the winter a closer relationship between county boards and the Dairymen's League in the northern part of the state and the Inter-

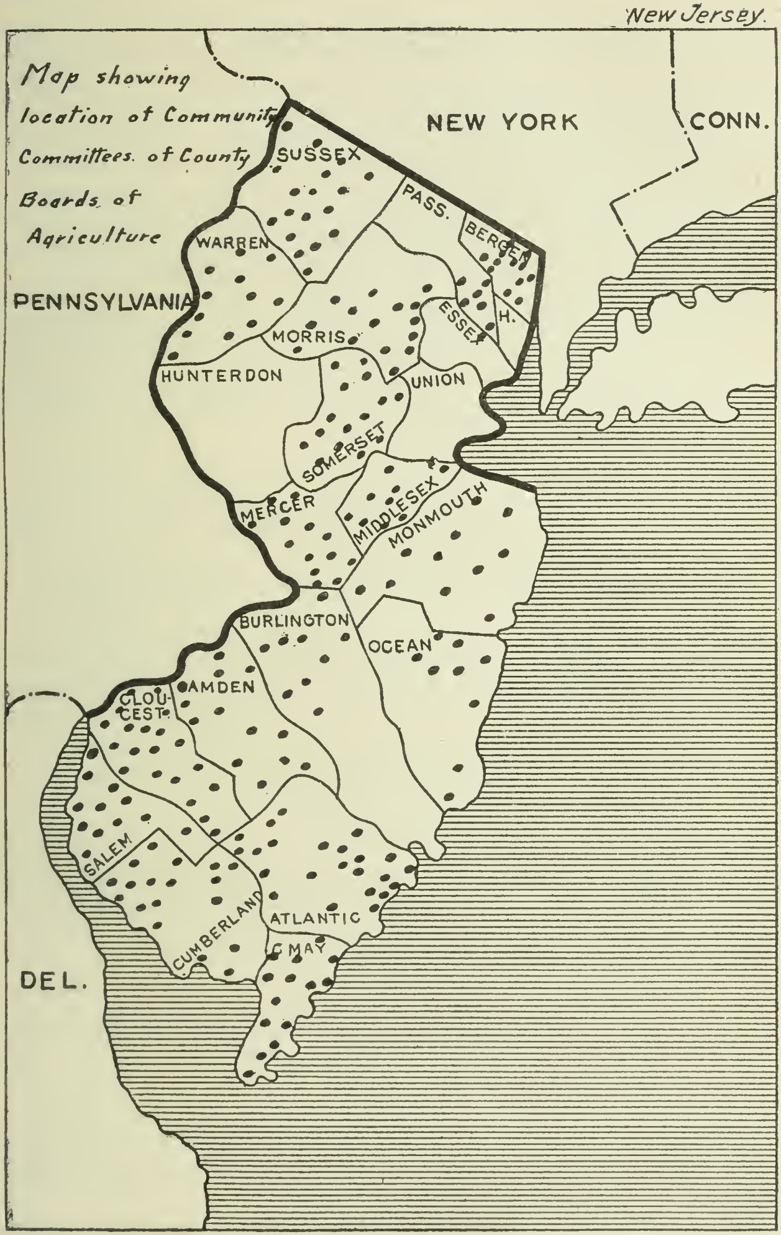

Fig. 1. Map showing location of community committees of county boards of agriculture.

State Milk Producers' Association in the southern part of the state, has been worked out. In the organization of the State Potato Growers' Association and the State Dairymen's Association, a definite relationship of county boards to these organizations has been a part of the constitution and by-laws of these state organizations. In both instances, the county committees of these state organizations will be elected at the annual meetings of county boards of agriculture by the members of the state association within the county who are also members of the county board. These county committees of the state associations also form the potato and dairy committees of the county boards.

In the various counties the program for farm demonstration work has been formulated through the close cooperation of the county council and executive committees with the county agents and representatives from the state college. In working out these programs the state leader and assistant state leader have met with executive committees and conferred with the county agents from time to time.

PUBLICITY

Five numbers of the "Farm Demonstration Exchange," a four-page monthly circular, have been issued. The material used in this circular was made up largely from the monthly project reports of county agents, with an occasional article by specialists and heads of departments. It is issued to county agents, members of the executive committees and chairmen of community committees of county boards of agriculture, and serves to keep the leaders in the county informed concerning the work of farm demonstration in the state. In addition to this circular letters have been issued to county agents, with the view of keeping them in touch with emergency problems and making suggestions that would be of value to the farmers of the state. During the last two weeks of February and the first two weeks of March a four weeks' publicity campaign was conducted throughout the state: one week of the campaign on the importance of securing and testing seeds; one week on making a labor survey, one week on the importance of the early purchase of supplies and one week on the repair of farm machinery before the season opened. An article has been given to the "Voorhees Farmer" each month on county agent work.

FARMERS' INSTITUTES

For the sake of coordination the State Department of Agriculture placed the direction of farmers' institutes in the hands of the state leader, who acted as director of institutes. Arrangements for all institutes were made through community committees of county boards of agriculture and county agents in the organized counties. These committees assumed the responsibility of taking care of all local arrangements and assisted in working out the program best adapted to local conditions. On the whole, this method of arranging programs and holding meetings has been very satisfactory, and despite the extremely severe winter and the large number of patriotic and other meetings held, the attendance and interest at farmers' institutes was excellent.

Institute Summary, 1917-1918

	Number of Institutes	Number of Sessions	Total Attendance
1917			
November	20	60	3,469
December	24	57	3,194
1918			
January	22	67	5,150
February	8	28	1,562
March	2	6	434
Total	76	219	13,809

Through the close cooperation of the local committees it has been possible to hold a greater number of meetings during the past winter than heretofore, at approximately the same cost.

Securing County Superintendents of Farm Demonstration

In response to the request of Essex County people, the Essex County Board of Chosen Freeholders during April made an appropriation to support farm demonstration work in the county. On June 10, Mr. I. T. Francis took up his duties as county superintendent of farm demonstration for the county.

During the year changes in the old counties made it necessary to secure new men for Atlantic, Burlington and Middlesex counties.

During the last week of March the States Relations Service, of the United States Department of Agriculture, made known their ability to pay the salary and expenses of assistant county agents to have charge of home garden project work in three or four New Jersey counties up to July 1, provided local funds could be secured to continue the work for at least two additional months. The people of Bergen, Mercer, Morris and Union availed themselves of this opportunity and men were found to take charge of the home-garden project in these four counties.

Reports and Conferences

County agents make weekly statistical reports of their activities and monthly project reports of progress and results of their demonstration work to the central office.

These reports serve to keep the central office in touch with the men in the field and are summarized and compared with a view to strengthening the work. After consulting with the specialists, the state leader has written to the county men making suggestions toward the betterment of the projects in the county. In addition to this, the state leader has made 50 visits to county agents and the assistant state leader 58 visits. The purpose of these visits has been to go over the work of the county superintendent in his county, to assist in developing the program of work in the county and to bring suggestions for bettering the organization and method of work. Assistance has been given in the mapping and charting of the work in the county in order that both the county agents and the farmers would have a clearer conception of the distribution of the activities of the office of farm demonstration.

Three state conferences and two sectional conferences have been held. The first was a two-day conference on January 21 and 22, for the consideration primarily of organization problems. On the second day representatives from the county boards of agriculture were present and told of the activities of their respective boards. This feature proved of great value to the leaders from the various counties of the state.

On March 5 and 6 a special emergency conference was held to formulate a program for food production in New Jersey. At this meeting representative farmers were present and took an active part in making the program for the state. On May 13 a special conference was held at Trenton to consider labor problems. Representatives from all organizations working on the problem in the state were present and the conference resulted in a clearer understanding between these various organizations and county superintendents of farm demonstration.

On June 10, 11 and 12 a field conference for South Jersey county superintendents was held in Cumberland, Salem and Gloucester counties, and on June 17, 18 and 19 a similar conference was held for North Jersey county superintendents in Mercer, Middlesex, Monmouth and Somerset counties. The purpose of these conferences was to enable the county men to study in the field methods of conducting demonstration work. Mr. L. R. Simons, of the United States Department of Agriculture, was present at these field conferences and gave some very valuable suggestions concerning organization.

Emergency Work

During the past year the county agents were very active in emergency work in their respective counties. The nature of this varied somewhat with the county, but the sum total was large.

Corn

Because of the long and severe winter seed corn was severely injured, making careful selection by testing for germination necessary. This was an unusual condition, because it is seldom that we have such long, cold winters that injure corn for planting. Consequently, the farmers throughout the state were not aware of this injury caused by the unusual winter. The county agents, with the aid of other members of the extension staff, informed the corn growers of this injury and demonstrated the truth by making actual tests of their seed corn. The county agents got the assistance of the public schools in testing the corn for the farmers of their districts. They carried out many actual tests themselves and gave the seed corn situation much publicity through the local press, meetings, news letters, posters and circulars.

The information was so thoroughly impressed upon the farmers that comparatively little poor or untested seed corn was used. Much seed corn was sold by those who tested and found their corn good, to their neighbors who had poor seed. Besides, there was much corn sold to farmers of New York, Indiana, Pennsylvania, Michigan and other states. The department has no complete record of the amount of corn sold, but it probably would not be overestimated if the amount was placed at 20,000 bushels. This sale was made possible through the activity of the county agents and others in the extension division. However, this was not the greatest gain through the testing of seed corn. Probably it would be conservative to estimate an increase of 10 per cent in New Jersey's corn yield, through the planting of good seed corn. New Jersey's corn crop is worth about $15,000,000 which would be a gain of $1,500,000 through the efforts for better seed.

The central office cooperated in this seed corn campaign carried on throughout the state during April. The county agents were visited by the state leader and assistant state leaders; Mr. J. B. R. Dickey, extension specialist in agronomy; Prof. John P. Helyar, seed analyst; Mr. A. M. Hulbert, state leader of boys' and girls' club work; and his assistant, Mr. William F. Knowles. The work was pushed in practically every county of the state.

In Atlantic County, the vocational schools took practically entire charge of the testing. In Bergen County, some publicity was given the situation, although the acreage of field corn in that county did not warrant a very extensive campaign. In Burlington County, Mr. P. F. Keil distributed a large number of rag-doll testers to schools and individual farmers, gave the situation publicity in the local papers, talked "Seed Corn Testing" at a number of grange meetings, and secured the cooperation of the schools in the work.

In Camden County, Mr. H. R. Cox met the rural teachers of the county in three meetings and asked for volunteers to take up the work in their schools. He secured the cooperation of about 50 per cent of the teachers; in addition, he brought the seed-corn situation up at 12 community committee meetings held.

In Cape May County, Mr. Stackhouse provides sand-box testers for each of his community chairmen who did testing for their neighbors, gave the situation wide publicity and secured the cooperation of the vocational schools in helping with the work in the county.

In Cumberland County, from a number of tests made, it would seem that the situation was apparently better than in any other county of the state. However, Mr. Oley secured the cooperation of five of the consolidated schools, besides interesting a large percentage of the farmers in testing their own seed.

Gloucester County gave some publicity to the situation and a letter was sent to the rural school teachers of the county stating the condition of the seed corn and asking their cooperation.

In Mercer County a number of schools took up the work and certain of the communities established a community testing center. Much publicity was given to the condition of the seed corn throughout the county. Very little untested seed was planted in this county.

In Middlesex County, Mr. Crittenden met the rural teachers of the southern end of the county and secured the cooperation of a number of schools. He gave the situation good publicity and followed up the work in the schools.

In Monmouth County, a great deal of work was done to arouse the farmers to the necessity for testing their seed, through publicity in the news letters and local press and through demonstrations at community meetings and personal visits by Mr. Douglass and Mr. Dickey to 35 or 40 of the schools of the county. The estimated increase due to good seed was placed at $60,000 by County Agent Douglass, which doubtless is quite conservative.

In Morris County, a number of schools cooperated in testing corn. Mr. Lippincott did some testing himself and endeavored to stir his county leaders and farmers to the necessity for testing all seed.

In Ocean County, Mr. Cooley secured the cooperation of the schools in doing the work.

In Passaic County, Mr. Wettyen did a great deal of personal work in testing corn and in showing the farmers how to test their seed.

In Salem County, Mr. Vail gave the situation good publicity and secured the cooperation of about 20 schools.

In Somerset County, Mr: Haines visited a school in each community, making that school a testing center for the community. These schools reported to him and he kept his community chairmen in close touch with the facts as he received them.

In Sussex County, Mr. Bennetch used a corn tester in his office which had a capacity of 900 ears, secured the cooperation of the schools and made use of a poster showing results in the county.

In Warren County, Mr. Houston and Mr. Hulbert worked largely through the schools. Mr. Houston also made use of a poster in his county.

In Hunterdon County, Mr. J. B. R. Dickey spent several days in visiting the high schools that had taken up the work during the latter part of March and in working with the teachers in a number of rural schools.

Nitrate of Soda

In carrying out the provisions of the Food Control Act, which authorized the President to procure nitrate of soda and dispose of the same for cash at cost for agricultural production, county agricultural agents were designated as the local agents in handling this nitrate. The county agent was instructed to appoint a committee of three or more local business men to assist him in the sale of nitrate.

These committees were appointed during the latter part of January and orders were taken up to February 4. Some delay was experienced in the delivery of nitrate; however, county agents were wholly unable to hurry or insure early delivery, because they had no control of the shipping and transportation arrangements. Every one responsible for the delivery of the nitrate acted in good faith, but the serious congestion of transportation facilities was the cause of the delay. The following table shows the amount delivered in New Jersey and the saving to farmers effected:

County	Tons	Saving Effected to Farmers
Atlantic	87.4	$2,235
Bergen	52.6	1,664
Burlington	170.5	5,115
Camden	36.0	720
Cape May	12.0	300
Cumberland	70.0	2,000
Gloucester	118.0	3,894
Mercer	23.0	500
Middlesex	13.6	396
Monmouth	164.3	4,430
Morris	20.0	600
Ocean	17.0	425
Passaic	16.9	390
Salem	30.0	750
Somerset	13.0	400
Sussex	12.6	430
Warren	2.3	159
Total	860.7	$24,408

FARM LABOR

The county agents have assisted the farmers in getting labor by informing them of or putting them in touch with any available supply. Approximately 1000 men have been obtained for farmers to date; some counties have received more than others. However, the available supply is not large and the problem remains for the farmers to hold the labor now employed on the farms and make that on the farms more efficient.

The extension division and county agents assisted the public schools in placing high-school boys on the farms. From records of the State Department of Public Instruction approximately 1500 high-school boys have been placed on farms to date. A number of units of the Woman's Land Army of America were started in the state. In spite of the labor supplied from the various sources the farmers will be short of their accustomed supply.

The solving of the labor problem will be one of greater labor efficiency of the existing labor on the farms, as well as an additional labor supply. Canada furnishes a good illustration of how this efficiency can be brought about. It is reported that two-thirds of the Canadian Army came from the farms, yet the crops grown and harvested in 1917 in Canada were 5 per cent greater than in any preceding year.

TOMATO GROWERS' ASSOCIATION

As a result largely of the activities of county agents Oley of Cumberland, Vail of Salem, Chase of Gloucester, Cox of Camden and Keil of Burlington, tomato growers' associations have been formed in those counties and a federation of the five tomato counties of South Jersey organized. Each county association has one delegate for each fifty members or portion thereof, but each county has only one vote in the federation. Through the efforts of this organization the price for tomatoes by the canners to the growers has been raised so that the majority of canners have been offered $30 a ton on contracts instead of $21 a ton, which was below the cost of production. This has already helped the tomato growers of South Jersey to the extent of thousands of dollars. The five associations in the federation have practically 1000 paid members.

ATLANTIC COUNTY

A. E. Wilkinson, Emergency County Agent

Mr. Albert Schaffle, who was assistant county agent in charge of the work in Atlantic County, resigned March 1, and Mr. A. E. Wilkinson was appointed county superintendent of farm demonstration April 1. Two meetings of the county board of agriculture were held during the winter: one in December and one in January. At the January meeting the following officers were elected:

President, Layton Parkhurst, Hammonton.
Vice-President, William Thompson, May's Landing.
Secretary, W. B. McDougall, Pleasantville.
Treasurer, J. L. Purzner, Egg Harbor.

During January and February, Mr. Schaffle, co-operating with members of the executive committee, organized 18 community committees in the county. During April and May, 6 additional committees have been formed, making a total of 24. In February a very successful 2-day institute was held at Bargaintown with a total attendance of 308.

The fact that no county superintendent of farm demonstration was in the county during March and that a change was made during the spring season, necessitated some interruption in the progress of work adopted by the executive committee during February. However, the projects being taken up this year are orchard management, demonstrations in tomato growing and poultry work. A more extended use of acid phosphate to balance stable and green manures will exert a marked influence on the crop yields in the county.

A systematic, consistent campaign on plant diseases has been carried on. As a result, all over the county farmers are spraying this year.

Mr. Wilkinson is spending some time in organizing a producers' association, the object of which is to better marketing conditions in Atlantic City and elsewhere.

BERGEN COUNTY

L. F. Merrill, County Superintendent

Two meetings of the county board of agriculture have been held, one in January and one in April. At the January meeting the following officers were elected:

President, Arthur Lozier, Ridgewood.
Vice-President, Aaron Courter, Fairlawn.
Secretary, J. M. Meyers, Westwood.
Treasurer, William H. Bomm, Westwood.

Subsequently, an executive committee was appointed by the president to assume local responsibility for farm demonstration work in the county. During March, 7 community meetings were held for the purpose of electing community committees. The average attendance at these meetings was 49. The people of the county have become very enthusiastic over the community plan of organization.

Mr. Merrill now has 12 community committees organized in the county. Three institutes were held with a total attendance of 890.

In project work Mr. Merrill is concentrating his efforts along lines of vegetable production, poultry management, home-grown seed potato production, alfalfa demonstrations, orchard demonstrations and a dairy record association.

At this time attention may be called to the progress of the demonstration of blocking tomato plants. Cooperators state that they have secured better and earlier plants by following these methods than they have ever grown before.

Initial steps have been taken toward the organization of a cooperative purchasing association to serve the farmers of Bergen and Passaic counties. This has been taken up by a committee appointed by the Bergen-Passaic Pomona Grange.

BURLINGTON COUNTY

P. F. Keil, Emergency County Agent

Mr. George T. Reid resigned as superintendent of farm demonstration January 31, and Mr. P. F. Keil was appointed February 1, as his successor.

The annual meeting of the county board of agriculture was held in January and the following officers elected:

President, J. A. Jones, Mt. Holly.
Vice-President, J. V. Bishop, Columbus.
Secretary, Byron T. Roberts, Moorestown.
Treasurer, Henry B. Wright, Burlington.

Organization in Burlington County is somewhat different from that in other counties, in that an advisory committee of 57 men representing practically every section of the county has local supervision of the work instead of a smaller executive committee.

During the winter six institutes were held, with a total attendance of 1210.

Mr. Keil has been of service to the tomato growers of the county in assisting in the organization of the tomato growers' association, which has succeeded in securing contracts for tomatoes which enabled the farmers to produce this crop at a fair profit.

The project work being undertaken this year consists of demonstrations and tests in the production of home-grown seed potatoes, corn variety tests, alfalfa demonstrations, cover-crop demonstrations, the dairy record association and minor work with truck crops. The alfalfa committee of the county board made arrangements to purchase 6340 pounds of alfalfa seed direct from the growers in the Northwest. This seed will be used by 37 different farmers.

CAMDEN COUNTY

H. R. Cox, Emergency County Agent

The annual meeting of the Camden County Board of Agriculture was held in December, at which the following officers were elected:

President, Benjamin Barrett, Blue Anchor.
Vice-President, Howard B. Neide, Laurel Springs.
Secretary and Treasurer, Everett Garwood, Laurel Springs.

As this was the first year for farm demonstration work in the county, the executive committee felt that the community committees should be appointed rather than elected. Consequently, 13 such committees have been appointed and during March and April Mr. Cox met with each of these committees and adopted the program of work formulated by the county council to each community.

The committee is taking the responsibility and proving of value in carrying out the demonstration work in the county.

Three institutes were held during the winter with a total attendance of 170.

The projects under way for the year are corn variety tests, soil fertility demonstrations and a cover crop campaign. In addition, miscellaneous work has been done with strawberries, extra fertilization of corn and testing soils for acidity. Mr. Cox has also assisted in the organization of the Camden County Tomato Growers' Association.

CAPE MAY COUNTY

J. A. Stackhouse, County Superintendent

Two meetings of the county board of agriculture were held during the winter, one in November and one in March. At the November meeting the following officers were elected:

President, Joseph Camp, Pierces.
Vice-President, Howard Hoffman, Cape May Court House.
Secretary, Ralph Schellinger, Green Creek.
Treasurer, Ralph Taylor, Cape May Court House.

In January the county council met and outlined the work to be undertaken in the county for this year.

Three institutes were held during the winter, with an attendance of 216.

Mr. Stackhouse cooperated with the Ocean City Bank in starting a pig club for both children and adults. The bank brought in 100 pigs and Mr. Stackhouse made arrangements to have the animals treated to prevent cholera as an insurance against loss.

In project work the demonstrations undertaken this year are corn community tests, orchard and soil improvement work; besides these, miscellaneous work is being done with bees, vegetable production and hogs.

During the winter Mr. Stackhouse held 14 community meetings, at which community committees were elected. As an example of the work of these committees, in the seed-corn campaign conducted in the county this spring, a sand-box was provided for the chairman of each community, who tested corn for his neighbors and used the box to show others in his community how the tests were made.

CUMBERLAND COUNTY

W. W. Oley, County Superintendent

The annual meeting of the county board of agriculture was held during November, at which the following officers were elected:

President, Leslie Platts, Bridgeton.
Vice-President, Morgan B. Husted, Cedarville.
Secretary, A. M. Seabrook, Bridgeton.
Treasurer, Walter B. Shute, Bridgeton.

Fourteen community committees have been formed in the county and have been of value in handling the emergency work.

Five institutes were held in the county during the winter, with a total attendance of 1,371.

Mr. Oley assisted in the organization of the Cumberland County Tomato Growers' Association, which has been of great benefit to the growers in the county.

The major projects in the county this year are soil fertility, orchard management, poultry management, and dairy record associations. The minor projects being conducted are along lines of work with vegetables, alfalfa, corn breeding and testing and soil acidity tests. In addition to these, Mr. Oley has given some time to Liberty Loan and Red Cross drives and to boys' and girls' club work.

As a result of the orchard work conducted in the county this and previous years, approximately 100,000 trees are being cared for as recommended by the office of farm demonstration. This increases the value of the fruit in the county from $250,000 to $500,000.

Essex County

I. T. Francis, Emergency County Agent

In response to the demands from the people of Essex County the state leader, with representatives from the Essex County Board of Agriculture and the West Essex Food Commission, met the Board of Chosen Freeholders on April 8, and secured an appropriation for farm demonstration for the county. On June 10, Mr. I. T. Francis was appointed emergency county agent.

Gloucester County

E. L. Chase, Emergency County Agent

Three meetings of the county board of agriculture have been held, one in December, one in March and one in June. At the annual meeting in December the following officers were elected:

President, P. Russell Skinner, Mullica Hill.
Vice-President, Elmer Clement.
Secretary, Miss Minnie Young, Swedesboro.
Treasurer, W. H. Borden, Mickleton.

During January, Mr. Chase organized 19 community committees and held a very successful county council meeting at which the program of work for the year was outlined.

One institute meeting was held at Swedesboro, with an attendance of 380. A great deal of time was given by Mr. Chase in assisting in the promotion of the Gloucester County Tomato Growers' Association, and later in the organization of the Produce Growers' Association, the object of which is to work on transportation and marketing problems.

The demonstration work consists of a tomato variety test, corn community test and orchard demonstrations, alfalfa demonstrations, the extra fertilization of corn and poultry management demonstrations.

MERCER COUNTY

Frank A. Carroll, County Superintendent

Three meetings of the county board of agriculture have been held during the year, the last of which was an automobile tour of demonstration work in the county.

At the annual meeting in November the following officers were elected:

President, Earle Dilatush, Robbinsville.
Vice-President, J. C. Errickson, Pennington.
Secretary, R. C. Haines, Hamilton Square.
Treasurer, A. Crozier Reeves, Lawrenceville.

A very successful membership campaign was conducted during December; a membership committee, of which the president of the county board was chairman, assumed full responsibility for the campaign, which resulted in an increase of members from approximately 300 to 1,606. The attendance at the January meeting of the county board was 1,365.

Twenty-five community meetings were held during the winter (with a total attendance of 1,199) for the purpose of better acquainting the people of the county with the work of the office of farm demonstration.

The executive committee and community committees have taken great responsibility, not only in planning the work for the year, but in carrying out the plans.

Two institutes were held during December, with an attendance of 255.

Mr. Carroll has given considerable time to the dairy interests of the county in the work of the Inter-State Milk Producers' Association.

Demonstration work under way consists of demonstrations and tests in the home production of seed potatoes, the dairy record association, calf feeding demonstrations and a boys' and girls' calf club. Miscellaneous work is being done toward increasing the amount of alfalfa grown in the county, swine production and orchard management.

A wholesale and retail farmers' market has been established in the city of Trenton through the cooperation of the Bureau of Markets of the State Department of Agriculture. The county agent's part in this was in getting together the farmers interested. The city of Trenton has appropriated $1,800 to put the market site in shape.

MIDDLESEX COUNTY

L. W. Crittenden, Emergency County Agent

Mr. I. L. Owen resigned as county superintendent of farm demonstration, March 1, and was succeeded by Mr. L. W. Crittenden, on March 22.

At the annual meeting of the county board of agriculture held during December, the following officers were elected:

President, John M. Evans, New Market.
Vice-President, John H. Van Dyke, Jamesburg.
Secretary, I. L. Owen, New Brunswick.
Treasurer, George Redshaw, Jr., New Brunswick.

The county council at its February meeting assisted in formulating the program of work for the year. They felt that time should be left for the county superintendent to handle emergency work and therefore recommended that regular project work be undertaken only in poultry and potato demonstrations and in strengthening the organization. At present nine community committees are organized.

One institute was held in the county at Dayton, with an attendance of 90. This was one of the most successful meetings of its kind held in the county for several years.

In May Mr. Crittenden succeeded in getting the dairymen of the county together and formed a dairy division of the county board of agriculture. It has been necessary for Mr. Crittenden to spend considerable time in getting acquainted with the county.

MONMOUTH COUNTY

Ellwood Douglass, County Superintendent

Arden M. Ellis, Emergency Assistant County Agent

At the annual meeting of the Monmouth County Board of Agriculture in November, the following officers were elected:

President, E. A. Sexsmith, Belmar.
Vice-President, H. E. Taylor, Freehold.
Secretary, Ellwood Douglass, Freehold.
Treasurer, Rhea Moreau, Freehold.

During the winter months Mr. Douglass held 22 community meetings at which farm demonstration work and topics of interest were discussed. Community committees were elected in 15 communities. In addition, four institutes were held with a total attendance of 1,022.

Demonstration work now under way consists of potato demonstrations, dairy record and feeding demonstrations, poultry work and orchard demonstrations. In addition to this, Mr. Douglass assisted the dairymen of the county in forming a dairy association.

The farmers of the county are coming to make more use of the office of farm demonstration; in fact, the work became so heavy that Mr. Arden M. Ellis was appointed emergency assistant county agent on May 16. Mr. Ellis had already proved valuable in following up demonstration work.

MORRIS COUNTY

H. S. Lippincott, County Superintendent

At the annual meeting of the county board of agriculture held in December, the following officers were elected:

President, G. E. Felch, Florham Park.
Vice-President, John H. Van Riper, Montville.
Secretary, Norman Spargo, Dover.

President Felch has been of great assistance in the organization work in the county. Committees have been elected in 15 communities of the county. During the winter 21 community meetings were held.

Four institutes were held in the county with an attendance of 536.

Through the cooperation of the county board of agriculture and the Farm Service League of Morristown, a cooperative purchasing association known as the Farm Service Exchange was organized in the county.

To utilize the pasture on the large estates of the county Mr. Lippincott has had 540 sheep brought into the county.

In demonstration work Mr. Lippincott is devoting most of the time to vetch and soybean demonstrations, dairy, poultry and orchard work.

OCEAN COUNTY

L. A. Cooley, County Superintendent

At the annual meeting of the Ocean County Board of Agriculture the following officers were elected:

President, D. W. Reid, Laurelton.
Vice-President, Ezra Parker, Barnegat.
Secretary, Charles N. Warner, Toms River.
Treasurer, Charles S. Green, Lakewood.

Seven community meetings were held during the winter at which the farm demonstration work was discussed and committees elected.

Three institutes were held with a total attendance of 268.

In demonstration work Mr. Cooley is concentrating his efforts on soil improvement projects, poultry demonstrations and alfalfa. He has assisted in the organization of boys' and girls' clubs, and reports 846 club members.

In addition to the project work, it has been necessary for Mr. Cooley to devote a great deal of time to personal visits and miscellaneous advice.

PASSAIC COUNTY

H. E. Wettyen, Emergency Demonstration Agent

At the January county council meeting of the county board of agriculture, the following officers were elected:

President, D. Henninger, Paterson.
Vice-President, C. Fred Day, Paterson.
Secretary, Aaron Laauwe, Paterson.
Treasurer, F. T. Torbet.

In Passaic County the county council is composed of the members of the six community comittees in the county. During the winter, Mr. Wettyen has held six community meetings and two institutes, with an attendance at the latter of 132.

During May, Mr. Wettyen assisted the dairymen of the county in organizing a county dairy association. This association is cooperating with the state association in conducting an educational campaign on the value of milk as food.

Demonstration work is being conducted with alfalfa, poultry, vegetable production, corn variety tests and the extra fertilization of corn. Some time is being devoted to boys' and girls' club work and home gardens.

SALEM COUNTY

W. C. Vail, Emergency County Agent

Salem County was organized for farm demonstration work during October of last year and Mr. W. C. Vail was appointed country superintendent on December 1. The following are the officers of the county board of agriculture:

President, H. M. Loveland, Bridgeton.
Vice-President, Clifford Crispen, Salem.
Secretary, Mrs. A. B. Waddington.
Treasurer, J. Gilbert Borton.

The executive committee is cooperating in the local direction of the work. During the winter Mr. Vail held 12 community meetings at which work for the year was discussed and community committees elected.

Three institutes were held during February, with an attendance of 579.

Mr. Vail assisted the tomato growers of the county in organizing the Salem County Tomato Growers' Association, which has been of value to the farmers in securing a fair price for their product.

The demonstration work under way consists of fertilizer tests with tomatoes, tomato and corn variety tests, extra fertilization of corn, soybeans, orchard and poultry demonstrations and a dairy record association.

SOMERSET COUNTY

H. C. Haines, Emergency County Agent

In December the farm demonstration committee of the county board of agriculture met with Mr. Haines and outlined the plan of reorganizing the board on the community basis. At the annual meeting of the board later in the same month, the constitution was amended, the following officers elected and leaders appointed in 15 communities:

President, Charles S. Hamilton, Somerville.
Vice-President, G. Scott Voorhees, Basking Ridge.
Secretary, Dr. W. H. Whiton, Neshanic.
Treasurer, A. A. Cortelyou, Somerville.

Since that time complete committees have been formed in these communities.

Three institutes, the best held in the county for some time, were conducted, with a total attendance of 428.

At the county council meeting in March the following program of work was outlined and is now being carried out: Dairy improvement, through a dairy record association, and feeding demonstrations; a more extended sowing of alfalfa, particularly in winter grain; increased corn production through seed testing, extra fertilization; and a variety test; increased use of lime, and poultry demonstrations. Minor work also has been taken up with orchards, potatoes, soybeans and cowpeas.

SUSSEX COUNTY

Paul B. Bennetch, County Superintendent

W. A. Houston, Assistant Emergency Demonstration Agent

At the annual meeting of the county board of agriculture held in December, the following officers were elected:

President, Theo. M. Roe, Branchville.
Vice-President, Thomas W. DeKay, New Milford.
Secretary, Ralph Decker, Sussex.
Treasurer, G. L. Lawrence.

Because of weather conditions during the early part of the winter, it was practically impossible to hold meetings in the county; however, toward spring Mr. Bennetch held 12 community meetings, at which plans for work in the communities were discussed and community committees elected. In the remaining six communties, the committees of the preceeding year held over.

During March a successful series of 6 barn meetings were held, at which dairy problems were discussed.

Four farmers' institutes were held, with an attendance of 573.

Mr. Bennetch has kept in close touch with the Dairymen's League locals, and has been of assistance to them in organization and work on the cost of milk production.

Practically all the demonstration work in the county bears upon more profitable dairying. The dairy record association and the calf feeding and dairy feeding demonstrations are directly concerned with dairy production. The continued efforts toward increasing the alfalfa acreage in the county, as well as the demonstrations of the value of acid phosphate on corn, tend to reduce the cost of feeding dairy cows.

In addition to these major lines of work, Mr. Bennetch had demonstrations with poultry, lime and soybeans.

Mr. W. A. Houston has charge of the orchard work in Sussex County. He has, however, spent the greater part of his time in Warren County, where he has successfully reorganized the Warren County Board of Agriculture on the community basis. Twelve community committees have been elected. Mr. Houston has organized a dairy record association in Warren County and has secured 11 cooperators in alfalfa demonstrations.

Summary of Activities of County Superintendents of Farm Demonstration, November 1, 1917, *to June* 30, 1918

County	Office Calls	Letters Written	Farm Visits	Meetings	
				Number	Attendance
*Atlantic	256	1,044	1,067	98	2,079
Bergen	396	860	391	65	3,510
Burlington,	827	966	567	47	3,438
Camden	135	956	563	54	1,571
Cape May	157	1,111	363	42	1,526
Cumberland	703	1,537	416	70	4,503
†Essex	15	22	24	6	114
Gloucester	277	745	453	72	2,734
Mercer	419	844	484	75	4,265
Middlesex	552	844	427	51	1,362
Monmouth	842	1,910	356	72	3,885
Morris	948	4,199	444	93	4,124
Ocean	177	824	360	48	2,148
Passaic	526	918	495	91	6,333
‡Salem	179	764	235	47	2,708
Somerset	470	994	401	47	1,466
Sussex	619	842	458	45	1,609
Total	7,498	19,380	7,504	1,023	47,375
Average per County per Month	59	153	60	8	370

*Office vacant during March, 1918.
†County superintendent appointed June 10, 1918.
‡County superintendent appointed December 1, 1917.

Summary of Field Demonstrations Under the Supervision of County Superintendents of Farm Demonstration, June 30, 1918

	Soils		Crops						Livestock					
									Dairy					
	Cover Crops and Green Manure	Lime and Fertilizer	Alfalfa	Corn Variety Tests	Soybeans	Truck	Potatoes	Orchard Work	Record Association Members	Feeding Demonstrations	Calf Feeding	Poultry	Miscellaneous	Total
Bergen	....	6	2	....	....	9	5	4	8	....	....	3	3	40
Burlington	3	....	41	8	....	2	35	....	6	....	....	....	16	111
Camden	79	6	1	7	....	....	....	....	....	....	....	1	3	97
Cape May	4	10	2	5	8	4	....	4	....	....	....	1	5	43
Cumberland	4	8	5	....	....	12	....	4	12	....	....	4	8	57
Gloucester	....	2	5	3	....	1	....	1	....	....	....	1	....	13
Mercer	....	....	15	....	....	....	17	1	24	....	4	....	19	80
Middlesex	....	....	....	....	....	....	11	....	6	....	2	4	....	23
Monmouth,	....	....	....	....	....	....	28	6	....	4	....	2	7	47
Morris	8	....	3	....	12	....	....	8	....	3	3	2	38	77
Ocean	5	8	6	....	2	....	....	....	....	....	....	4	4	29
Passaic	1	7	5	2	....	2	....	....	....	....	....	3	6	26
Salem	....	10	....	4	2	3	2	5	22	....	....	3	1	52
Somerset	1	1	29	2	7	....	2	1	16	3	....	2	....	64
Sussex	....	34	33	....	3	....	....	8	41	6	3	2	....	130
Warren	....	3	11	4	....	....	....	....	13	6	....	....	....	37
Total	105	95	158	35	34	33	100	42	148	22	12	32	110	926

REPORT OF THE STATE HOME DEMONSTRATION LEADER

M. ANNA HAUSER

The home demonstration work in New Jersey has been characterized by unusual growth during the eight months covered by this report.

Home demonstration work is now recognized as a necessity, and the women of the state are looking to the college for help in solving the problems that come up in the home just as the men of the state look to the college for advice in carrying on agricultural pursuits.

In previous years only the most far-sighted people recognized the need for this particular type of extension work, but at present, when food plays such an important part in winning the war, the great mass of people realize the importance of having trained women to whom they can turn for advice in regard to the ways in which the food substitutes can be used and the perishable products conserved to best advantage.

During these months the endeavors of the staff of home demonstration agents have been confined almost entirely to emergency food problems carrying out the recommendations made from time to time by the United States Food Administration. The many different lines of home demonstration work which are of a more educational nature have been temporarily discontinued to make way for the war work which is designed to give immediate results.

The unusual results attained have been made possible by the splendid cooperation of women's committees that took the local responsibility in the counties and cities, by the helpful spirit of cooperation shown by the farm demonstration agents and through the harmonious relations which exist under the leadership of Director Agee.

The state leader wishes to commend the fine spirit of service shown by the untiring efforts put forth by the members of the home economics extension staff.

On March first Miss Helen E. Minch, specialist in home economics, became assistant state home demonstration leader, taking the place of Miss Nelle Johnson whose resignation went into effect on that date. Miss Minch has been especially helpful in planning and carrying out the numerous local and state-wide food campaigns that have been such a marked success, in preparing the necessary literature and adapting the old standard recipes to the new war-time conditions, in preparing an outline for the standardization of home-canned goods that are to be offered for sale, and in helping new home demonstration agents get the work started in counties and cities, besides giving a great many single demonstrations upon request.

ORGANIZATION OF COUNTIES AND CITIES FOR HOME DEMONSTRATION

On November 1, 1917, only three counties were organized for home demonstration work. In July, 1918, 5 counties and 8 cities were organized for this work. The appropriation of money by Congress for home demonstration agents was liberal and by a special arrangement the work was started in a number of places without waiting to secure local financial cooperation to meet the running expenses according to the rule laid down by Congress.

After the people in different cities and counties had an opportunity to observe the work for a month or two the state leader asked the local authorities for the financial support that would be necessary to continue the work. According to the agreement entered into by the New Jersey

State Agricultural College with the Washington office, the local appropriation must be sufficient to cover the expense of providing and maintaining an office as some central place, to purchase demonstration equipment and demonstration materials and transportation of the agent and her equipment from place to place.

From $400 to $500 is the amount of money necessary to bear the local expenses for carrying on work in a city on the present basis, and about $800 is necessary for the county work. The additional amount is needed in the county to provide a means of conveyance, such as a Ford automobile. The local expenses for this work are so small because the office expenditures are kept very low. In counties the home demonstration agent usually shares the office with the farm demonstration agent. In cities arrangements can usually be made to have desk room provided in one of the public offices and part-time stenographic help given by a stenographer who had not previously been kept busy. In either case there is very little, if any, expense for office rent or stenographic help. During the last 8 months, 2 counties, Middlesex and Morris, and six cities, Trenton, Jersey City, Paterson, Passaic, Bayonne and Princeton, have come forward with the necessary appropriation.

The entire salary of these emergency home demonstration agents is paid by national funds It is hoped that the value of this work will be thoroughly demonstrated to counties and cities receiving assistance from emergency funds, that they will be ready, when such appropriation ceases, to provide funds for the continuation of this service. Two additional counties, Gloucester and Hunterdon, and three other cities, East Orange, Elizabeth and Newark, are at present negotiating for the funds necessary to carry on the home demonstration work.

When women in a county or city desire to begin home demonstration work they communicate with the state leader. If the demand is sufficient, she arranges for a hearing before the city commissioners or other authorities, in the case of the county, before the Board of Freeholders, at which she or the director of extension, together with representative women, ask for a local appropriation of funds. Owing to the desire of the National Government at this time to give all the people of the county the benefits of home demonstration work, it is now possible to place an emergency home demonstration agent in every county and in every city with a population of at least 40,000 if there is financial cooperation to meet the local running expenses as previously indicated in this report. When the appropriation amounting to $400 or $500, in a city, and $800 in a county, is made, a trained woman is appointed as quickly as possible. No woman, however, is chosen before being passed upon by a committee of representative women.

The County Board of Agriculture

Under the original organization of the board of agriculture system in New Jersey, any man or woman interested in agriculture could become a member of the county board. Although women were eligible for membership very few women affiliated themselves with the organization and they took very little or no part in its activities. In the few years previous to 1916, women in rural homes began to realize the necessity of studying their problems in groups in order that they might make progress with their husbands and better adapt home conditions to the progress of the age in which they were living. They continued to believe that the home is the woman's sphere, but they began to realize that community interests should be their interests and that they needed to gain by the experience of others if their homes were to maintain the proper relation to society and their families receive the benefit of the progress that was being made in the many phases of science that woman naturally deals with in her vital work of home making. During the summer of 1916, in order to meet the changing conditions in our country, the county boards of agriculture were reorganized and a new constitution adopted in every county where the organization was active. At that time both men and women realized that rural women should be organized to do definite work which tended toward home and community improvement. Therefore, under the new plan of organization, women's work under the county board was placed upon an equality with men's work. Definite provision was made for the organization of community committees of women known as home economics committees; also for having an equal number of woman members on the county council and an executive comittee of women who should direct the activities of women in the county just the same as the men have these committees for directing work along agricultural lines.

The complete plan as the reorganization was effected, with the new constitution and by-laws of the county board of agriculture, is printed in the 1917 report* of Mr. John H. Hankinson, who was state leader of farm demonstration at that time. To save space it will not be repeated here. Almost immediately after the reorganization was effected the women in certain counties realized that they needed a paid, trained worker who should give all of her time to the development of women's work in the county, and carry on the work that their communities should outline, just as the farm demonstration agent carried on the work that the committees of men outlined. To fill this need the first county home demonstration agent went into the field in New Jersey on May 15, 1917. Since then the home demonstration work has grown to such an extent in our own state and throughout the entire country that its permanency is assured. The definite work that women can do as they are organized under the county board is very necessary to the fullest development and progress that can be made along all lines in rural communities.

Starting the Home Demonstration Work in Counties

When a county home demonstration agent is ready to go into a county, a representative committee of 7 or 9 women is formed. This committee may be the women's executive committee of the county board of agriculture or a special committee appointed or elected by the board, or it may simply be a group of women who are interested in the work and are leaders in their particular communities. This committee then meets with the state home demonstration leader and the county home demonstration agent to discuss plans of work. The committee determines at its first meeting the community centers in the county and selects a leader for each to which the county home demonstration agent may go for cooperation when working in that section.

At this meeting a series of demonstrations is usually planned to be given in the different community centers. These demonstrations are designed to give the women of each community definite information and help along some particular line. At the same time these meetings help the worker to become acquainted with her people. The first efforts of the county home demonstration agent are directed to learning the problems of the county and to outline two or three primary projects which would help toward their solution. The quickness with which she can meet the women of the county and learn local conditions and her ability to help the local women work together, are the measures of her initial success.

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*Annual Report of the Division of Extension in Agriculture and Home Economics for the year ending October 31, 1917. N. J. State Agr. Coll. Extens. Bul. 13.

As soon as possible she should get the women of the county organized under the county board, if that has not already been done. The most effective work can be accomplished only when there is a live committee of women working in each community. This committee should be made up of one representative from each of the different existing women's organizations of that community. For instance, there should be on the committee at least one woman from each of the following organizations: the grange, women's club, ladies' aid, missionary guild, parent-teachers' association and any other women's organization that may be formed in the community. This organization under the county board of agriculture is purely democratic, and any action that it takes and any work that it plans is designed to reach every woman and affect every home in that community. There should be one woman on the community committee who is not a member of any organization in order that the unorganized group of people also may be reached.

Starting the Home Demonstration Work in Cities

When a home demonstration agent is ready to go into a city, a representative committee of about 7 or 9 women is formed. This committee may be the mayor's food committee or a special committee appointed or elected by the city authorities or it may simply be a group of women who are interested in the work and are leaders in their own communities. This committee then meets with the state leader and the city home demonstration agent to discuss plans of work. The committee determines at its first meeting the natural centers in the city and selects a leader in each to which the city home demonstration agent may go for cooperation when working in that section.

At this first meeting a series of demonstrations is usually planned to be given in the different centers of the city. These demonstrations are designed to give the women of each ward, district or section, as the case may be, some definite work to do and information and help along some particular line. The first efforts of the city home demonstration agent are directed to learning the problems of the city and to outline two or three primary projects which would help toward their solution. The quickness with which she can meet the women of the city and learn local conditions and her ability to help the local women work together are the measures of her initial success. As soon as possible she should get the women of the city organized with a live committee working in each ward, district or section in which the city naturally lends itself to division for most advantageous work. This committee should be made up of one representative from each of the different existing organizations of that section, such as the women's club, civic improvement club, ladies' aid, missionary guild and any other women's organizations that may be found there. Such an organization is purely democratic and any action that it takes and any work that it does is designed to reach every woman and to affect every home in that section. There should be one woman on the committee who is not affiliated with any organization in order that the unorganized group of people also may be reached.

Scope of Work of County and City Home Demonstration Agents

The work of the home demonstration agent may be broadly divided into project work and miscellaneous work. The project work embraces all that which is planned in advance and which is definitely outlined before being undertaken, for example: projects on different phases of food conservation, clothing, health, sanitation, child welfare, etc. Under miscellaneous work is classified, assistance given to individual women or groups of women upon request. The work is carried on by means of demonstrations, lectures, individual conferences, home visits, letters, articles for the press and distribution of literature.

All important oral advice or suggestions, whether given in office, field or by telephone, are confirmed by letter, a copy of which is placed on file.

In keeping records of project work, an outline for each project is made, showing the name, object and method of work. Each project outline is separate and all information pertaining to that project is put together. A record of each demonstration in a project is kept, showing the name of the project, and name, address and residence of the cooperator. A record is kept also of any meetings that may be held in connection with the demonstration, number of people inspecting the demonstration and data on important phases.

The county and city home demonstration agents make weekly reports to the state leader of home demonstration, showing for each day of the week the type of work performed, number of homes visited, number of demonstrations given, office calls, telephone calls and meetings held or addressed. The weekly total of letters written, number of circular letters mailed, articles published and number of bulletins distributed also are reported. Monthly reports also are sent to the state leader. Copies of the weekly and monthly reports are sent to the United States Department of Agriculture, Washington, D. C.

CONFERENCES

In order that helpful experience in one county may be of use in another, and for the purpose of having common counsel, quarterly conferences of the county and city home demonstration agents are held at the College of Agriculture, at New Brunswick. The work done in these conferences usually requires two or three days and consists of the presentation of different important lines of work by committees, individual home demonstration agents, specialists or outside speakers. The exchange of ideas between the different agents is a very important feature of the conferences.

A special one-day conference was held in March for the purpose of putting on a "Potato Campaign" throughout the entire state. On January 24, a state-wide home economics conference was held at Trenton. This brought together leading women from every part of the state to consider important phases of home economics extension work.

COMMUNITY CANNING AND DRYING CENTERS

Between November first and July first, the time covered by this report, very little work is done in canning and drying centers. A few of these centers have started work this season and at this writing plans are under way for opening a great many more plants throughout the state.

PEACH ORCHARD BY-PRODUCTS EXPERIMENT

Plans have been completed for running a very interesting experiment in connection with the New Jersey State Experiment Orchard, at Vineland. The object of the experiment is to find out whether or not it is a paying proposition for a large commercial peach grower to run a canning and preserving plant in connection with his orchard to take care of the cull stock which, as a rule, is not marketable at a profit. Two trained workers will be employed during August and September and parts of July and October to turn all the cull peaches from the experimental orchard into canned peaches, peach syrups and marmalades.

FOOD SURVEYS

Two state-wide food surveys were made at the special request of the United States Department of Agriculture and the United States Food Administration. The state leader takes this opportunity to thank all the women of the state who helped so generously in making it possible for the extension division to meet this request.

WORK OF THE STATE-WIDE HOME DEMONSTRATION AGENTS

A very important need is met by having a limited number of home demonstration agents who have their headquarters at New Brunswick, and work from the central home demonstration office at the State Agricultural College. They carry on home demonstration work in counties of the state where there is no resident home demonstration agent and give assistance to the county and city home demonstration agents when extra help is needed. They also fill the numerous requests that come in to the college for talks on home economics subjects.

In several instances these workers were placed for a limited time in a city, a county or a district of several counties where there was an unusual demand for work and yet the people were not sufficiently interested to furnish the funds for local expenses that are necessary to place a home demonstration agent in a county or city on full time. Miss Helen E. Minch has been a member of this corps of workers during the entire eight months covered by this report, changing her type of work only slightly when she became assistant state home demonstration leader, March 1, 1918. Since November first, Miss Mabel Tallant spent one month in Sussex County, when she was called to the Service as a Red Cross nurse. Miss Ruth Wallis was employed as a member of the home economics extension staff only 4 months and spent 3½ months of that time in Perth Amboy. Miss Clara Forte was on the staff about five months, one-half of which time was spent working in Burlington County and the other half in the district including Gloucester, Camden and Burlington counties. Miss Edna Gulick began work January 15, 1918, and Miss Marjory A. Eells began February 1, 1918. These two young women have been doing miscellaneous work filling requests for talks and demonstrations in all parts of the state.

A few statistics will serve to show the work that was done by those who have worked from the central office at New Brunswick. During the eight months, from November 1, 1917, to July 1, 1918, these workers have given 253 demonstrations at which 15,090 people were reached; and 44 talks or lectures that reached 6,802 people. The total number of meetings held is 297 with an attendance of 21,892 people. The average number of people at each meeting was slightly over 73.

An itemized list of the number of demonstrations and talks on different subjects will show the kind of work upon which the greatest emphasis was placed.

DEMONSTRATIONS

Subject	Number of Demonstrations	Attendance
Uses of Cornmeal	25	1,210
War Breads	56	4,000
War Meals	6	228
Canning of Fruits and Vegetables	30	2,151
Home Canning and Curing of Meats	25	1,210
Drying of Fruits and Vegetables	8	792
Liberty Cakes	6	191
Home-Made Fireless Cooker	30	1,976
Meat Substitutes	24	1,139
Uses of Leftovers	2	80
Salads and Salad Dressings	15	927
War-Time Desserts	6	281
Potato Dishes	20	905
Total	253	15,090

TALKS

Subject	Number of Demonstrations	Attendance
What Shall We Eat?	3	230
Meat Substitutes	1	65
Home Decoration	1	55
Home Demonstration Work	4	200
Value of Food for the Child	1	11
Value of War Food	6	577
Health	3	568
Potato Campaign	1	50
Time and Labor Saving in the Home	3	285
Miscellaneous	21	4,761
Total	44	6,802

Total Demonstrations	297
Total Attendance	21,892

The community meetings seem to be very popular, and 100 of the above meetings were of this type. The different organizations that were served by the remaining 197 meetings are as follows: granges, farmers' institutes, women's clubs, parent-teachers' associations, county boards of agriculture, merchants' associations, Council of National Defense, civic clubs, girls' patriotic league, church organizations, etc. Eleven home visits were made at which definite assistance was given. Seven times service was given by judging domestic science and domestic art exhibits.

FOOD CAMPAIGNS AND EXHIBITS

The state-wide home demonstration agents cooperated with the women's and merchants' associations committees in a number of places throughout the state by furnishing demonstrations for food campaigns. As a rule demonstrations were given every afternoon and evening during the period covered by the campaign. These, with the accompanying food exhibits that were gotten up by the local people, proved to be a very effective means of getting the food situation before the people of the state.

Campaigns covering a period of one week were held at the following places: Newark, Elizabeth, Paterson, Atlantic City, Camden, New Brunswick and Millville. Campaigns covering a period of two or three days were held at Washington, N. J., Plainfield, Westfield, Glen Ridge, Summit and Vineland. Series of three, four or five demonstrations were given at the following places: Carney's Point, Bordentown, East Orange, Haskell, Caldwell, Flemington and Lambertville.

A state-wide potato campaign was held in April which aided materially in getting the old potato crop used and in saving quantities of wheat.

The state leader wishes to commend especially the efforts put forth by the committees of women, the merchants and the home demonstration agents in making these food campaigns the great success that they proved to be in every case.

Plans have been completed for carrying on an intensive milk campaign in Trenton and Paterson in July and later in other parts of the state.

During Agricultural Week in January a food exhibit was staged in the Armory at Trenton. Food exhibits were also made at the Trenton Inter-State Fair and at a number of the county fairs. An intensive campaign of demonstrations on the canning and drying of fruits and vegetables was carried on during the entire period of the Inter-State Fair.

FARMERS' INSTITUTES

The plan of holding separate sessions for women originated last year was continued in a large number of farmer's institutes this year. Besides the meeting in which the county home demonstration agents cooperated, the state-wide workers attended 35 such meetings. A campaign was put on during the winter to encourage farmers to preserve in different ways the beef and pork that was slaughtered on farms in the winter, so that the usual supply of meat provided could be made to last over the entire year. At twenty-five of the institutes demonstrations were given on "The Canning and Curing of Meat." The canning of cockerels was also encouraged.

The state leader recommends that a separate women's session be held in connection with a larger number of farmers' institutes during the coming season.

CORRESPONDENCE AND LITERATURE

Direct service through correspondence offers a wide field of usefulness for the state-wide workers. Many thousands of people within the state are accustomed to write direct to their state institutions when problems arise. During the last eight months 3,092 letters went out from the central office. Thirty-seven articles were written for the newspapers and 57,354 bulletins and circulars sent out.

Another feature of the home demonstration work was the writing of 8 publications. Two of these were bulletins entitled "Home Canning and Curing of Meats" and "Good Breads That Save Wheat." The remainder were circulars and leaflets entitled "Potato Recipes," "How to Prepare Potatoes in Many Ways," "Meat Substitutes," "New Jersey Market Standards for Home Canned Fruits and Vegetables," "Victory Recipes," and "Liberty Cakes." The last two leaflets were prepared for special campaigns. The United States Food Administration and the United States Department of Agriculture were very generous in supplying literature on the different timely food subjects. A great deal of literature from these two sources was distributed in the state.

WORK OF COUNTY AND CITY HOME DEMONSTRATION AGENTS

Bergen County

Miss Carolyn F. Wetzel, Home Demonstration Agent

During the last nine months of home demonstration work in Bergen County the agent has given 41 demonstrations on wheat substitutes, uses of potatoes, white sauce variations, meat substitutes and extenders, uses of left-overs, war meals and canning. Twenty-nine lectures on time and labor-saving in the home, conservation, nutrition, and uses of substitutes were given. Two talks on clothing and a millinery demonstration were given. Nineteen meetings were held for the girls in club work. Thirty-seven home visits and school visits were made and 17 committee meetings were attended; 2 exhibits of canned products were judged; 1 county exhibit was held, as well as 2 smaller local exhibits. The total attendance of the meetings held was 4,882 and 6,000 bulletins were sent out. A permanent mailing list is being made on which there are now over 500 names. Assistance was given in compiling a cook-book, besides the writing of recipe leaflets.

Mercer County

Miss Lauretta P. James, Home Demonstration Agent

The lines of work to which particular attention is being given by the women of the county board are as follows:

1. Food Conservation (in accordance with the requests of the United States Food Administration).
2. Child Welfare.
3. Ways and Means of Saving Time and Energy at Work.
4. Girls' Club Work.

These different branches of our work have been taken up at community meetings. They were also considered by all those who joined in the auto tour of the county. Valuable work has been done in showing the use of wheat substitutes at exhibits planned by a number of community committees.

Summary of Work

Home Visits	113
Office calls	43
Telephone calls	177
Number of letters written	512
Circular letters and post cards	740
News letters each month	1,250
Articles for local press	6
Number of women members of county boards	750
Number of communities with community committees of women	9
Exhibits arranged by community committees	11
Community meetings with an outside speaker	15
Demonstrations given on:	
Meatless Meals	31
Use of Wheat Substitutes	
Cottage Cheese Salads	
Canning	
Various Ways of Serving Potatoes	
Talks at meetings:	
Time and Labor Saving	30
Food Conditions	
Old Garments Made New (illustrated)	
Woman's Work in the County Board	
Girls' Club meetings	25

Committee meetings	12
Demonstrations and talks outside of county	6
Total number of meetings held	107
Total attendance	4,329
Bulletins distributed	12,031

MIDDLESEX COUNTY

Miss Josephine C. Cramer, Emergency Home Demonstration Agent

Home demonstration work started in Middlesex County, October 15, 1917, beginning immediately with the winter work of food conservation. During the winter the coal shortage delayed the work considerably, but as soon as warm weather came meetings were again scheduled. Since then there have been 15 demonstrations on the "Uses of Cornmeal," emphasizing the home-ground meal, and 593 people were reached. There have been 9 demonstrations on "War Bread" to 457 people, 28 on "Potatoes" reaching 1,360, and 28 demonstrations on various subjects such as "Salads," "Meat Substitutes," "Fish," "Uses of Skim Milk," etc., with a total of 1,788 people in attendance. This spring some demand for canning has resulted in 5 canning demonstrations, the attendance being 209. Besides the demonstrations there have been 28 lectures given to 2,955 people, bringing the total number of people reached to 7,362. These lectures and demonstrations were given before parent-teacher associations, granges, women's and girls' clubs and community gatherings of all sorts —also a few in private homes with the intention of arousing enough interest among women who do not meet together to get them to attend meetings of larger groups. This method proved successful and has led to the desire for a community canning center and a housekeepers' club, both of which are under way toward organization.

From the office 10,066 bulletins were distributed, 2,695 circular letters sent out, 349 personal letters written, 81 articles written for the local press, 16 leaflets prepared; 208 persons have called at the office; there have been 1,104 phone calls and the demonstrator has made 538 personal calls. Two new canning clubs have been organized.

During the week from April 8 to 13 an intensive series of 12 lecture demonstrations were given reaching 1,225 people. The following week was designated as "Potato Week" in New Brunswick, and the next week in the county. During this time 12 demonstrations and 6 lectures on "Potatoes" were given.

Splendid cooperation was given by the Freeholders of the county, New Brunswick Board of Trade, Home Defense League, Woman's Committee of the Council of National Defense, Home Service League, City Improvement Society (New Brunswick, N. J.,) County Board of Agriculture and Neighborhood House Board of Directors. These organizations have been vitally instrumental in starting the home demonstration work in Middlesex County.

MONMOUTH COUNTY

Miss Eunice Straw, Home Demonstration Agent

A—Meetings held:

I—Demonstrations:

Subject	Number	Attendance
"Uses of Cornmeal"	15	329
"Cake Making"	1	42
"Meat Substitutes"	10	339
"Bread Making"	1	43
"Balanced Meals"	4	100
"Salads and Salad Dressings"	2	51

Subject	Number	Attendance
"Canning and Curing of Meats"	1	20
"Wheat Substitutes"	5	140
"Fireless Cooker"	2	16
"Sewing"	1	6
"Sugarless Desserts"	1	40
"Canning of Fruits and Vegetables".	20	630
"Drying of Fruits and Vegetables"	2	27
"Uses of Potatoes"	2	60
"War Cakes"	2	34
	69	1877
II—Talks:		
"Community Organization"	4	115
"Uses of Cornmeal"	1	250
"Meat Substitutes"	1	60
"Potato Campaign"	1	50
"War Cakes"	1	14
	8	489

B—Office activities:	
Telephone calls	455
Personal calls	131
Letters written	339
Circular letters	4737
Bulletins distributed	8939
Newspaper articles	7
C—Field work:	
Homes visited	81
Days spent with state specialists	11

D—Other lines of work where time has been given:

1. *Farmers'Institutes and County Board Meetings.* An effort was made this year for the first time in this county to arrange a separate program for the women for one session of the farmers' institute meeting. The attendance and interest shown by the women was very gratifying in all cases. An effort has been made also to tie up the men's and women's work into a closer organization. At present there are 450 women members on the county board and their attendance at the meetings shows an increasing interest in the work.
2. *Woman Labor.* Assistance has also been rendered the housewife by supplying labor from the Newark Employment Bureau and other sources. Ten women have been placed since November first.
3. *Potato Campaign.* Over 3,000 circular letters were sent out to the teachers, ministers, librarians and editors of the county, giving suggestions for ways in which they could assist in the campaign. Many requests came back for recipes, sermonic material, posters, etc. The subject of potatoes was also brought up at all meetings wherever possible.
4. *Canning Plants.* Assistance has been given also in the way of selecting equipment, calculating costs and profits, labor and methods of canning, to a wayside market where it is hoped any surplus fruits and vegetables left from the market will be saved by canning.

Fourteen women's community committees have been doing active work throughout the winter and spring months. Six other communities have become interested, but a complete organization has not yet been effected.

GIRLS' CLUB WORK

1. Fifteen club meetings were personally conducted by the home demonstration agent.

2. Twenty visits were made to local club leaders.

3. Ten demonstrations were given to clubs. (These are listed with the demonstrations under home demonstration work.)

4. Four talks were given to schools on club work—number addressed 690.

5. Five schools were visited with the assistant state club leader who gave demonstrations on the "School Luncheon." Some of these schools intend to serve a hot lunch at the noon hour next year. Two hundred and sixty children and mothers were present at these meetings. The clubs have been reorganized and enrollments brought up to date. Three new clubs have been organized, making 14 clubs in the county with a total enrollment of 353 members.

6. Seven conferences were held.

   (1) A conference of club leaders and school supervisors and principals was held to discuss club work in the school. As a result of this meeting a number of supervising principals have become interested in club work and the schools of one city have organized canning clubs.

   (2) A conference of the local club leaders was held to give the new leaders assistance and inspiration in carrying on their club work. As a result of this meeting the ladies of one town have hired a trained home economics worker to meet with their club girls once a week and supervise the canning.

7. Exhibits:

   (1) One hundred jars of canned fruits and vegetables were exhibited at the January meeting of the State Board of Agriculture, held at Trenton, by the clubs of this country.

   (2) A local contest was held by the Allentown Canning Club at the farmers' institute meeting, where over 100 jars were exhibited and $20 in cash prizes given.

The total number of meetings held for home demonstration work and club work were 111, with a total attendance of 4,514.

MORRIS COUNTY

On November 7 Miss Margaret C. Hayes began work as emergency home demonstration agent for Morris County. At the county board of agriculture meeting in December a resolution was adopted to make the work permanent and make an appropriation to meet the expenses of the work. While in the county Miss Hayes gave 15 demonstrations on "Uses of Potatoes," "Cornmeal," "Canning," "Drying of Fruits and Vegetables," "Meat Substitutes" and "School Lunches." Five talks were given on food conservation and a two-day campaign for food conservation was held in Morristown during April.

The total number of meetings held is 21 and the total number of people reached 1,314. Besides the 6 home economics clubs which were organized in the county, 4 women's clubs and 16 communities were served. Miss Hayes reports 14 home visits, 1,205 letters written, 44 news articles and 1 "Bread" bulletin published, and 3,743 bulletins distributed.

Miss Hayes resigned and discontinued her work April 30, 1918. Miss Cora Hoffman has been appointed to fill the vacancy.

BAYONNE

Miss Harriot Ware, Emergency Home Demonstration Agent.

Home demonstration work has been carried on in Bayonne for six months.

The committee on food demonstration appointed by the mayor divided the city into ten districts with the public school buildings as centers. District leaders were appointed in each section. The Vocational School printed 3,600 recipe leaflets on the following subjects: "Use of Cereals," "Cornmeal," "Rye and Barley," "Breads Using Wheat Substitutes," "Uses of Stale Bread." "Recipes Without Wheat," "Recipes Using Potatoes," "Meat Substitutes" and "Salads."

A "Potato Campaign" was conducted during the months of April and May with the cooperation of the food administrator, public schools, Free Public Library, Civic Betterment Club, Women's Club, Bayonne Review, Bayonne Times, Jersey Journal, grocers, merchants, boy scouts and churches.

Eighty demonstrations were given at which the attendance was 829. Ninety-two home visits were made. Demonstrations were given as follows: 24 on "Wheat Saving," 6 on "Milk and Cheese," 4 on "Wheat Substitutes," 16 on "Potatoes" and 8 on "Canning." Twenty-seven articles were published in the local papers, 5,367 bulletins distributed and 130 letters written.

CAMDEN

Miss Carolyn R. Simons, Emergency Home Demonstration Agent.

Emergency home demonstration work has been carried on in Camden City for 5½ months—from January 16 to June 30. In that time 61 demonstrations have been given and 1,356 people reached. The demonstrations in Camden have been given in churches, in public schools, in the rooms of the Public Service, the Deaconess House, the Catholic Lyceum and the parochial school. The subjects taken up were chiefly: "Uses of Wheat Substitutes," "Meat Substitutes," "Saving Sugar" and "The Saving of Fats," with attention being directed at this time particularly to "Uses of Fresh Vegetables," "Canning of Fruits and Vegetables" and "The Making and Use of the Home-made Fireless Cooker." In April a campaign was held urging the use of more potatoes to save wheat. This resulted in the selling out of all old potatoes within a short time. In the week June 10 to 15 a general food campaign was held with two daily demonstrations in various parts of the city. At the 12 demonstrations in that week there was a total attendance of 379 people. Fifty-two press articles were published and 2,017 bulletins distributed during the 5½ months of the work.

ELIZABETH

On January 14 Miss Eleanor K. Johnston began work as emergency home demonstration agent for the City of Elizabeth. During the four months that Miss Johnston was in Elizabeth, 23 demonstrations were given on the uses of wheat substitutes, ways of serving fish, the construction and use of the home-made fireless cooker and meat substitutes. Five talks were given on food conservation and a week's campaign was held to encourage the conservation of food by the people of Elizabeth. The total number of meetings held is 28 and the total number of people reached 1,655. These meetings were held in missions, churches, stores and women's clubs. Miss Johnston reports 50 home visits, 34 letters written, 17 articles published in the local papers and 17,376 bulletins distributed.

Miss Johnston resigned and discontinued her work April 20, 1918.

JERSEY CITY

Miss Bertha Cold, Emergency Home Demonstration Agent.

Work in Jersey City did not virtually begin until March, the latter part of February having been devoted to selecting centers for lectures and demonstrations and to securing suitable headquarters for the demonstration agent.

Meetings were held in churches or parish houses principally, in public schools, settlement houses, clubs, etc. In several cases a series of demonstrations was given, a week or a fortnight elapsing between meetings. Wherever meetings were held such places were called centers.

The number of different centers visited one or more times was 24. The total attendance at these meetings was 1,211; the number of demonstrations 38; the number of subjects 7. Lectures were given in these centers. The subjects presented are the following, arranged in the order of the number of times each subject was given more than once: "Wheat Substitutes," "Potatoes," "Meat Substitutes," "Bread," "Fireless Cooker," "Wheatless Sugarless Cakes," "Conserves" and "Canning." Lectures on "The Meaning of Food Conservation" were delivered before 3 groups in distinctly different parts of the city.

Since the work was begun in Hudson County the home demonstration agent has called on 13 families, written 80 letters, and 10 press articles, sent out 362 circulars and distributed 4,450 bulletins. She has also had 8 office calls and 33 telephone calls.

During the "Potato Campaign" an address was given before the Merchants' Protective Association to enlist their cooperation.

In the county, outside of Jersey City, meetings were held in 7 towns, in 9 different centers, 2 lectures were given, and 18 demonstrations held on 7 different subjects with an attendance of 668. The subjects of the demonstrations were the following, in the order of the number of times given: "Wheat Substitutes," "Meat Substitutes," "Potatoes," "Bread," "Cooking the Tougher Cuts of Meat," "Canning of Fruits and Vegetables," "Making of Conserves With Less Sugar," "Jelly-Making." One lecture was given on the "Marketing and Preparation of Foods," another on the "Meaning of Conservation."

NEWARK

Miss Louisa Vanuxem, Emergency Home Demonstration Agent.

During the 5½ months of food conservation work carried on in Newark, 80 demonstrations and lectures were given, 7,600 people being reached through this means. The nationalities represented in the audience were American, Italian, Irish, Jewish, Polish, German-American, etc., and consisted of well-educated housewives, clerks, factory workers, cooks and others. Twelve out of the sixteen wards participated in the work.

There were 75 office and 35 field conferences. Two hundred letters were written, 300 letters, including general correspondence, circular letters, etc., sent out, 3,000 "flyers" and 10,000 recipes, and 10,000 bulletins were distributed.

Volunteer assistants helped and numerous organizations cooperated. Excellent publicity was given through the newspapers, churches and schools.

PASSAIC

Miss Regine Porges, Emergency Home Demonstration Agent.

During the nine months in which the home demonstration work has been carried on in Passaic, 112 meetings have been held with a total attendance of 8,225. Lectures and demonstrations have been held in public and parochial schools, church halls, and before women's clubs. Six demonstrations were given in private homes with the audiences ranging from 10 to 15. The winter work consisted chiefly of lectures on conservation in general, and demonstrations on "Wheat Conservation," "Meat Substitutes" and the "Use of Left-Overs." The spring work was carried on by means of a series of demonstrations in 5 different centers. This series lasted 7 weeks and included the following subjects: "Use of Potatoes," "Wheat Substitutes," "Meat Savers," "War-Time Desserts," "Sugar Saving Sweets," "Fat Conservation and Soap Making," "Canning" and "Dehydration of Fruits and Vegetables."

The summer headquarters of the home demonstration agent will be at the canning kitchen at the high school. Men, women and children may bring their products to this center and can or dry them under supervision.

There have been 82 office calls, 435 telephone calls, 29 newspaper articles, 399 letters, and 7490 bulletins distributed.

PATERSON

Miss Margaret H. Hartnett, Emergency Home Demonstration Agent.

Home demonstration work has been carried on in Paterson since October. Conservation of food through substitution and preservation has been emphasized. Demonstrations and lectures have been given before groups of women in churches, schools, business places and homes. Several demonstrations have been given before organized groups, clubs, red cross units, etc. Substitution was emphasized during the winter. This, together with preservation of food, will be the program carried out during the summer.

"Wheat Substitutes," "Uses of Potatoes," "Meat Savers" and "Uses of Left-overs" were the topics of demonstrations given. Extensive plans have been made for canning and drying. Some canning demonstrations have been given.

The total number of meetings, including demonstrations and lectures, has been 126, with an attendance of 7486.

In March a Food Conservation Week was held in one of the large department stores. The State Bureau of Markets conducted a potato campaign in Paterson and the local demonstrator was assisted by state specialists. To introduce the subject of drying, a mass meeting was held, at which Miss M. Anna Hauser, state home demonstration leader, gave a lecture on "Food Conservation," and Mrs. Grimes, a government expert, gave a demonstration on "Drying."

There have been 70 office calls, 343 telephone calls, 267 letters written, 17 articles written, 458 circular letters sent out and 3,628 bulletins and 5,238 recipe sheets distributed.

TRENTON

Miss Lena Pierce, Emergency Home Demonstration Agent.

On February 12 Miss Margaret Cornell began work as home demonstration agent for Trenton. A very able food committee who took the responsibility of directing the work locally cooperated from the very beginning. Local funds were provided immediately to pay the running expenses of the work.

Miss Cornell resigned and discontinued her work in Trenton on May 15. During the three months that Miss Cornell worked she reports 29 demonstrations given at which 1,030 people were reached. She wrote 16 press articles and 27 letters and distributed 2,100 bulletins.

Miss Lena Pierce took up the home demonstration work for Trenton on May 15, and continued it on the same basis that Miss Cornell had begun. During the one and one-half months that Miss Pierce has been working she reports 19 demonstrations at which 420 people were reached. Eight of the demonstrations were given on "Good Breads That Save Wheat Flour," 6 on "Canning of Fruits and Vegetables," 4 on "Milk and Eggs" and 1 on "Lunch-Box Suggestions." She also reports 33 telephone calls, 33 personal calls, 28 newspaper articles written and 1,070 bulletins distributed.

APPOINTMENTS

1917	
Mar. 5.	Clara P. Forte, Emergency Home Demonstration Agent.
Dec. 16.	Ruth Wallis, Emergency Home Demonstration Agent.
1918	
Jan. 1.	Caroline R. Simons, Emergency Home Demonstration Agent.
Jan. 1.	Louisa Vanuxem, Emergency Home Demonstration Agent.
Jan. 1.	Eleanor K. Johnston, Emergency Home Demonstration Agent.
Jan. 16.	Edna Gulick, Emergency Home Demonstration Agent.
Feb. 1.	Marjory A. Eells, Emergency Home Demonstration Agent.
Feb. 1.	Bertha Cold, Emergency Home Demonstration Agent.
Feb. 1.	Margaret Cornell, Emergency Home Demonstration Agent.
Mar. 1.	Helen E. Minch, Assistant Home Demonstration Leader.
May 16.	Lena R. Pierce, Emergency Home Demonstration Agent.
June 1.	Ethel H. Osmond, Emergency Home Demonstration Agent.
June 16.	Norine Webster, Emergency Home Demonstration Agent.

RESIGNATIONS

1917	
Nov. 27.	Mabel Tallant.
1918	
Mar. 1.	Nelle Johnson.
Mar. 1.	Helen E. Minch, Specialist in Home Economics.
Apr. 15.	Ruth Wallis.
Apr. 20.	Eleanor K. Johnston.
Apr. 27.	Clara P. Forte.
May 1.	Margaret Hayes.
May 15.	Margaret Cornell.
June 30.	Harriet Ware.

REPORT OF THE STATE CLUB LEADER

A. M. Hulbert

In our last annual report we confined ourselves chiefly to a brief summary of results accomplished during the year ending October 31, 1917, and to a statement of plans and policies for the future. It shall be our purpose in this report to show to what extent those plans have worked out successfully and to indicate the soundness of the policies which were held at that time.

Organization

During the year there has been a decided growth in interest in club work throughout the state. In order to meet the demands it has been necessary to secure a third assistant state leader and to increase greatly the office help and facilities for handling the amount of work necessary to be done.

At the present time there are three assistant state club leaders: Miss M. Ethel Jones, who, with Miss Sara T. Jackson, has charge of the girls' work, and Mr. W. F. Knowles, who assists the state leader in organizing and supervising boys work. Miss Jones is a graduate of Pennsylvania State College, Iowa State Agricultural College, and Teachers' College, Columbia University. Miss Jackson is a graduate of the Home Economics Course in the Agricultural College of Cornell University. Mr. Knowles grew up on a farm in Delaware and is a graduate of Harvard University. Mr. Knowles came to his present position on February 16, 1918, taking the place of Mr. C. O. Smith, who resigned February 1, 1918.

The office of the state club leader has been fully equipped and organized so that there is provision for handling the work and for filing correspondence, records and reports.

Under the emergency appropriation the following counties have been organized under county club leaders on part time: Camden, Cumberland, Hunterdon, Mercer, Ocean, Sussex and Warren. The work in these counties is carried on under the plan of cooperation that was agreed upon between the extension division and the State Department of Public Instruction. Our experience leads us to believe that this plan is fundamentally sound in principle, and practical in its application. We do believe, however, that it would be possible to have club work a little more closely identified with that of the county boards of agriculture, and that this closer relation would strengthen our work.

Morris County is organized under a county leader on full time on a plan that is somewhat different from the one followed in other counties. Cooperation in this county is with the Morris County School Industrial Association. The executive committee of the association acts as the advisory committee in club work and the county leader works under the direction of this committee. This plan secures the cooperation of the county superintendent of schools, the county farm demonstrator, the president of the county board of agriculture and the chairman of the farm service league of the county, all of whom are members of the executive committee.

Th State Legislature at its last session amended the home-rule law making it legal for boards of freeholders to make appropriations for club work. Under this law Morris County appropriated $500 and Bergen County $600 for this work. The Bergen County appropriation was afterward diverted and made available for use in employing an assistant county farm demonstration agent who took charge of the boys' work.

VOLUNTARY FINANCIAL SUPPORT

During the last year county and local committees throughout the state have contributed to promoting club work the sum of $3,018.93. This amount includes $500 that has been given by the Inter-State Fair Association. It does not include a rather considerable amount of money that is being used to pay county and local leaders, furnish office accommodations and help, printing, etc., in the several counties.

PUBLICATIONS

The state leader, with the assistant state leaders and the extension specialists, has prepared two bulletins, namely: Extension Bulletin 16 of the extension division of the State Agricultural College, and Circular 17 of the State Department of Agriculture, the latter being published for the use of the garden club members. Bulletin 16 is general in character and deals with such questions as the relations between club work and the public schools, the policy of organization and administration, the nature of club work, enrollment and general direction, a brief summary of projects, club fairs and exhibits, etc. Circular 17 deals with the garden project and contains directions and suggestions for the twelve months of the year.

PROJECTS

Nine separate projects have been undertaken in this state, namely: corn growing, potato growing, home gardening, canning, poultry raising, pig raising, calf raising, cooking and sewing and garment making. There have been 544 clubs organized with a total enrollment of 7,507. Organized club work is being carried on in 15 of the 21 counties. The largest enrollment in any one county to date is 1,139, where 8 projects have been undertaken.

FOLLOW-UP MATERIAL

Work in the poultry, pig and calf-raising projects is followed up regularly each month by letters of directions or instructions being sent to each club member through the county or local club leaders. These letters are prepared by the extension specialists and sent out through the state club leader's office.

We are hoping to be able to combine these follow-up letters of instructions into bulletins for publication for use in our work another year. This will reduce expenses and office work.

SUMMARY OF ACTIVITIES

During the period covered by this report the activities of the state leader and his three assistants may be summarized as follows:

	Number	Attendance
Meetings held with organized clubs..........	115	3,529
Demonstrations—all kinds....................	89	3,477
Personal visits to club members.............	113	246
Field meetings..............................	324	22,401
Organization meetings.......................	125	4,218
Conferences with committees, etc.,..........	63	644
Exhibits held 8, exhibitors 755.............	755	3,025
Groups of leaders trained...................	4	70
Club festivals..............................	5	1,275
Farmers' institutes addressed by state leader..	17	1,142
Miles traveled..............................	33,615	
Number of letters written...................	2,552	
No. of circular letters prepared and distributed,	16,521	

FIELD OF ACTIVITY

Our work has been confined very largely to the rural communities, as it is there that help is most needed. The work in the larger towns and cities is provided for very largely by local appropriations and agencies. We have given assistance and furnished printed matter, however, to a few towns and cities, and there seems to be a growing tendency on the part of the people in the larger communities, as the work of the extension division of the State Agricultural College becomes better known, to look for help from our workers.

We are of the opinion that it would be wise to adopt for the future, as the work develops, a policy that would make it possible for us to meet the calls that come from the centers. This would require that some special study of urban conditions and needs be made and that in time we come to have in our department people whose training and experience fit them specially for that kind of work.

COUNTY LEADERS AND THEIR ACTIVITIES

Paid county leadership has been proven a decided success. Work that bears so vital a relation to the life of the country child as that of putting through a definite project is of enough importance to demand the attention of people who bear the relation of personal responsibility to it.

We are of the opinion that it is better not to stimulate young people into starting things unless we are in a position to stay with them and give the direction and help that are essential to a successful completion of any piece of work. In the appointment of county leaders it has been our policy to go into only such counties as were ready for organization and then to limit the number of projects undertaken, thus making it possible for the county leader to keep in touch with all phases of his work.

The following statements will indicate something of the methods that are employed by the various leaders in their work. One leader reports that she has her clubs so organized and her schedule of meetings so arranged as to make it possible for her to attend at least one club meeting a day for the months of July and August. For each meeting a program of work is arranged and something of a definite character is done. Another leader reports that regular schedules of meetings and demonstrations have been planned. In this same county "special-event" days have been planned; on one occasion the members of the poultry clubs from a given section of the country will be taken to a poultry farm where work in judging and culling will be done or instructions given in the care and feeding of young chicks. In this same county a series of meetings for local club leaders is being held. The object of these meetings is to study plans of organization, follow-up work, record keeping, etc. In counties where there are calf clubs a great deal of work is done with the boys in dairy judging and feeding. Judging and demonstration teams in the various projects are being trained in all the organized counties.

Relations With the Schools

The relations which have existed between the club workers and the school officials in the state have been most pleasant. In every county where our work has been organized we have been most cordially received and have been given most hearty cooperation. The spirit of the agreement providing for cooperation between the Department of Public Instruction and the extension division of the State Agricultural College has been manifested everywhere.

It has been a pleasure to work in cooperation with Prof. A. K. Getman, supervisor of vocational agriculture for New Jersey. His suggestions have been most helpful and the numerous conferences which we have held with him have led to a clearer understanding of relations of the various agencies that are concerned with the promotion of agricultural education in New Jersey.

Cooperation With Extension Specialists

We desire to acknowledge the cooperation that has been given the club workers by the extension spcialists. In the preparation of the garden circular (No. 17), Mr. R. W. DeBaun, extension specialist in market gardening, rendered most valuable assistance; Mr. J. W. Bartlett, extension specialist in dairy husbandry, in the preparation of monthly follow-up circulars and in giving instructions to calf-club members has helped to make this part of our work popular; Mr. V. G. Aubry, extension specialist in poultry husbandry, has prepared monthly letters to young poultry raisers and otherwise given valuable assistance to us in our work.

During March and April the state club leaders worked in cooperation with Mr. J. B. R. Dickey, extension specialist in agronomy, in the seedcorn testing campaign that was carried on in the state. We are of the opinion that this was a most valuable piece of educational propaganda.

Assistance By Members of College Staff

Prof. H. R. Lewis has offered much valuable suggestion in poultry work. Through his cooperation we were furnished over 125 free settings of eggs to club members throughout the state.

Mr. J. M. Hunter has generously assisted in our pig-growing project by preparing monthly letters of instructions to club members. These have been sent out regularly.

Annual Club Meeting

The annual state club meeting that was held at the College on December 27 and 28, 1917, was attended by 155 club members from 15 counties. There were 21 leaders in attendance. We feel that this annual meeting can be made even more helpful to junior extension work than it has been in the past. There are many evidences that it has come to be regarded throughout the state as a very definite part of the year's work. Practically every county in which club work is organized, local and county committees are planning to send larger delegations to the 1918 meeting than have ever attended before.

The success of the 1917 meeting was due largely to the cooperation which was given by the college officials, including President W. H. S. Demarest, Mr. Luther Martin, Registrar, and Mr. E. C. Brown, Y. M. C. A. Secretary.

Some Conclusions

Our experience of the past year has convinced us of a few things which we regard as fundamental. We are convinced (1) that club work is essential and that it should form a definite part in the scheme for the education of boys and girls, particularly those who live in rural communities; (2) that the school is the institution mainly through which our activities should be promoted; (3) but that all other public and semi-public institutions should be coordinated with the school in the work; (4) that the understanding which we have with the Department of Public Instruction is fundamentally sound and that relations should be even closer than they are at the present time; (5) that not only would the interests of club work be more efficiently served but that extension and general educational work as well would be better served if a somewhat closer relation could be established between club leaders and the county farm bureaus; and (6) that paid county leadership is necessary to the performance of satisfactory club work, and that ultimately there should be county leaders on full time in all of our organized counties.

REPORT OF THE SPECIALIST IN VEGETABLE GROWING

R. W. De Baun

A vigorous campaign for increased vegetable production in New Jersey is being conducted throughout the Garden State as a war emergency measure. There are over twenty military camps in the state, and the war industries have brought many thousand people to its towns and cities. It is estimated that over twenty million people are now living within sixty miles of Trenton, the capital of our state. This great mass of people must be fed. All staple food products are excessively high-priced, and they must be conserved as far as possible for emergency use by our nation and her allies. The best substitute for the staple products is vegetables, because they must be produced quickly, in great abundance per acre, and New Jersey can produce them near to the markets.

The extension division realizes that no matter how many vegetables are produced in New Jersey, the supply cannot meet the increased demand because of the imperative need for the conservation of meat, wheat, poultry products, sugar, etc., and the prohibitive prices of those staple products.

Just when tremendous demands for greater production are placed upon our growers, they find themselves terribly handicapped by the scarcity and exceedingly high price of labor, fertilizer, seed and equipment. The tremendous increase in the cost of production, the lack of essential labor, and the uncertainty of returns have a tendency to cause the growers to reduce their acreage. The specialists in vegetable growing and the county agents have endeavored to make the commercial producers realize that the consuming public and the country need more vegetables than the growers can produce. The cooperation of labor bureaus was assured. Many hundred growers were encouraged to save some of their own vegetable seed the year before, and those who did not do so were warned to order their supplies earlier than usual. Although the cost of fertilizer was double its former prices the producers were made to realize that *economical maximum production* resulted from generous and judicious use of this costly material. At this time it is expected that fertilizer and manure will be scarcer and higher in price next season than ever before. The specialists in vegetable growing believe that profitable and abundant vegetable production depends upon the fertility of the soil; therefore, a vigorous campaign is being planned in cooperation with the specialist in agronomy for more extensive planting of soil-improvement and cover crops this season, so that vegetable production another year may be maintained or increased in spite of the imminent shortage of fertilizers and manure.

Since November 1, 1917, the specialist in vegetable growing has delivered addresses on some phase of vegetable growing before 71 meetings, with a total attendance of 8,807, and has written 931 letters. Twenty-four of his articles have been published in the Weekly News

Letter, and from March until July "Timely Suggestions on Vegetable Growing" were sent to all papers in the state each week. Each weekly installment consisted of about 700 words, and they were published regularly by about 45 papers. The circular of the "Home Vegetable Garden" has been revised with illustrations, and a circular has been written on the "Winter Storage of Vegetables for the Home." Many farms were visited for personal inspection, consultation and advice upon the request of the managers. Several definite lines of work which received special attention are reported on below.

SEED SAVING AT HOME.

Prior to the war we imported immense quantities of vegetable seeds from Europe, but now most of this source of seed is cut off, just when a vigorous campaign for increased vegetable production is being promoted in this country. A shortage in the vegetable seed supply would handicap production; therefore, at every opportunity, whether by letter, consultation, lecture or writing for the state papers, the vegetable growers were warned of the coming conditions, and were advised to save seed from their vegetable crops. Special outlines giving full directions for the growing, selection, harvesting, and cleaning of vegetable seed at home were prepared. Upon request the farmers received their copies from the extension division of the State Agricultural College, or the county agents in the respective counties. The outlines include directions for saving seed from the following crops: asparagus, beets, cabbage, cantaloupe, carrots, celery, cucumbers, eggplants, kohlrabi, lettuce, onions, peppers, pumpkins, squash, spinach, sweet corn, tomatoes and turnips. It is estimated that one thousand farmers have been influenced to give the selection of their vegetable seed more careful attention, and to save more of their own seed than they otherwise would have done. Especial interest in this work has been shown in Atlantic, Burlington, Camden, Cumberland, Gloucester and Monmouth Counties.

THE HOME VEGETABLE GARDEN.

Because of the increased cost of food materials, the home gardeners were more enthusiastic this spring than ever. Many illustrated lectures were given for their special benefit, showing them the elementary principles necessary for success. The things emphasized were proper soil preparation and fertilization, timely and proper planting, thinning, cultivation and insect control for those vegetables which grew easily and quickly and produced a heavy yield of good food material. This was a war emergency measure undertaken in order that fertilizers, seed, and energy may be put to efficient use instead of waste. Thousands of circulars on this subject were mailed out, and several garden planting demonstrations were held with from 25 to 325 spectators to witness the preparation and fertilization of the soil, and the planting of 11 different vegetables on a plot 10 feet square according to a definite plan. The crowds around each of these demonstrations constantly increased and it is believed that they were especially helpful in increasing efficiency and production. Special demonstrations in the planting of gardens were carried out in Camden, Mercer and Middlesex counties.

Soil Improvement for the Vegetable Growers.

The successful and profitable production of vegetables is directly dependent upon a fertile soil. The growing crops demand great quantities of plant-food and the humus is quickly used up by frequent cultivations. Fertilizers are very high-priced and manure is almost unobtainable. Most truckers cannot spare their ground for sod in a rotation, and the maintenance of stock for the production of manure is usually impracticable for the commercial trucker. Therefore, it is apparent that if production is to be increased the fertility of the soil must be maintained or improved by the more frequent use of soil-improvement crops and cover crops. A chart has been prepared by the specialists in vegetable growing and in soil fertility showing how the various vegetable crops can be advantageously interplanted and followed each month in late summer with the various soil-improving cover crops. Free copies of this chart are being distributed to all of the vegetable growers in the state. This campaign should result in the planting of cover crops on several thousand acres which would otherwise be bare over winter and less productive the following season.

Early Tomato Strain Test

The early tomato strain test is being repeated this season in Gloucester County by Mr. E. L. Chase, the county agent. At the time of writing this report (July 1) the first few ripe fruits are being harvested, so that definite results are yet unobtainable. However, the demonstration is in excellent condition and splendid results are expected. Last season, seed furnished by some early tomato growers gave a total yield double that produced from other strains of seed. Some strains produced a few early fruits and others yielded their full crop quite early, but the bulk of the crop was late. Seed from one grower produced tomatoes with 16 per cent of rough fruit, while other seed produced only 3 per cent of rough fruit. There are 33 samples of early tomato seed in the test this season. Each sample is furnished by growers of the state who have an excellent reputation for the production of this crop and who have selected their own strain of seed for a few years. The test will surely demonstrate the difference in production due to the inherent qualities of the seed. The demonstration has aroused greater interest and care in the selection and saving of home-grown seed for this valuable crop.

Seed from what was considered to be the most excellent strain in last year's demonstration has been distributed to six prominent commercial growers in different parts of the state for trial in their fields this season. Early season reports indicate that it is an extremely desirable, high-quality, early tomato, and it may soon become generally adopted throughout the state.

Organization of Canhouse Tomato Growers

Early in the winter it became known that the Government was particularly anxious that there be a very heavy production of tomatoes for the canhouses this season. The canned product seems to be most excellent food for use by the army and navy. The leading growers in southern New Jersey and the county agents believed that the most effective way to insure a big acreage was for the canners to offer an attractive contract price to the growers. At the same time, the cost of production had greatly increased. Therefore, the leaders in the canhouse tomato counties decided to form definite organizations, so that the growers could carefully consider and estimate their probable cost of production and demand a price that promised to cover the true cost of their materials.

County tomato growers' organizations were formed in Burlington, Camden, Cumberland, Gloucester and Salem counties, with a total paid-up membership of practically 1,000 members. Many enthusiastic meetings were held in each county, and a committee from each county organization represented their respective counties in the Federation of County Associations. Through the united efforts of the growers and the county agents, the interests of the producers were splendidly represented before the Food Administration at Washington, D. C. The canners and growers were made to realize that their actual cost of production would be much higher than they had at first supposed. The annual production of canhouse tomatoes in New Jersey is over 100,000 tons, and when it is understood that the prevailing contract price is $30 a ton instead of between $20 and $24, as it undoubtedly would have been, one can readily realize what the results of these organized efforts will mean to the growers in the greater returns they will receive for their labor. Besides this, the resulting increased acreage should help to meet the need of the Government for this very essential war emergency food material.

Growing Canhouse Tomatoes

In Camden County, three commercial tomato growers limed half of their tomato field immediately after plowing the ground. The county agent, Mr. Cox, had previously tested the soil to determine its lime requirements, and he is taking notes of the appearance of the plants and fruits at various times during the season. The difference in the growth of the cover crop which will be sown at the last cultivation will be noted, and the cooperating growers will keep accurate picking records of the tomatoes on the limed and unlimed sections. Thus the actual results from the use of lime for tomatoes on sour soil will be accurately demonstrated for the benefit of our enormous canhouse industry.

In Cumberland County, 7 commercial growers are demonstrating the relative value of 10 different varieties of tomatoes for the cannery. The county agent, Mr. Oley, distributed the seed and will record his observations on soil, fertilizer, treatment, plant vigor, quality of fruit, and adaptability. Each of the growers will keep a record of the date and amount of each picking, so that the total yield, the time of ripening, and the relative value of each variety will be accurately demonstrated. It is hoped that a particularly heavy producing variety will be found for general distribution.

In Salem County, 3 commercial growers are demonstrating the relative economic value of various kinds and amounts of fertilizer, and 2 are conducting splendid variety tests. This work was started by the county agent, Mr. Vail, who resigned in June, but is being followed up by the specialist in vegetable growing until a successor to Mr. Vail can be appointed.

Emergency Work

Every recommendation or suggestion from the State Agricultural College tested out by the growers becomes, in a certain measure, a demonstration. There are hundreds of these going on, and of course it is impossible to give them special attention. However, it is well known that the growers are already giving the selection of their seed sweet potatoes more attention, and better conditions are provided in their plant beds, so that the destructive sweet potato diseases may be materially avoided. The practice of side dressing cantaloupes with nitrate of soda at the last cultivation, as is constantly recommended by the extension division, is rapidly becoming a regular cultural practice among the growers as a means of avoiding the blight, and of increasing the yield and improving the quality of the crop. Lime is being used more efficiently, because it is being applied on the vegetable crops which especially respond to it. The development of a disease-resistant strain of Ruby King peppers is being worked on in Cumberland County. Variety tests are being carried on in Burlington County with beets and cabbage, and the storage of root crops was successfully directed and demonstrated last fall and winter in Middlesex and Monmouth counties.

Twenty short and timely articles have been sent to every paper in the state through the weekly News Letter, and timely material has been furnished the county agents so that they would have accurate suggestion to send out to all the growers in their counties. Thus practically all feasible measures have been used to keep the growers in touch with the quickly-changing conditions, in order that vegetable production may be materially increased in the Garden State as a war emergency food measure, in spite of the handicaps with which our commercial producers are contending.

REPORT OF THE SPECIALIST IN MARKET GARDENING

C. H. Nissley

Many of the vegetable projects outlined by the specialists for this year were drawn up at the suggestion of either the county agents or practical vegetable growers who had a definite problem to deal with and a definite result to obtain. All projects deal directly with greater food production. Many of these problems are not merely local ones, but are of a general nature, of great importance to growers throughout the state, and largely brought on by the abnormal conditions caused by the war.

In the organized counties these demonstration projects are carried on in cooperation with the county agents, while in the unorganized counties the specialist has secured the cooperators, and is following up the results of the various outlined projects carried on. Because of the earliness of this report, definite results cannot be given on any of the major projects, but a few of the minor projects are already completed, the discussion of which will follow under the heading of "Projects."

A schedule of dates was arranged last February, designating one day each month to be spent with the county agents in their respective counties to outline and follow up project work. These suggested dates were sent to the various county agents and were approved. The county agent and the specialist could therefore plan his work accordingly, and to the best advantage, the plan working out very well in practically all cases.

This last year, and especially during the early spring, much of the time had been devoted to emergency work. The specialists' activities consisted of giving lectures whenever requested on some particular phase of gardening, in giving advice both by letter and by personal inspection of certain tracts of land to be used for vegetable production, in the testing of soils sent into the office for acidity determination, in helping in the planning of demonstration garden work now carried on by the majority of the large cities, and in advisory visits to various towns upon request of the mayor's committee or committee in charge. Since November 1, 1917, 84 lectures have been delivered on some phase of gardening, with a total attendance of 8,396; 331 farms have been visited; and 527 letters have been written. Timely articles were also contributed to the Weekly News Letter and to the "Monthly Suggestions for the County Agents' News Letter and Press Articles."

PROJECTS

Vegetable Production in the Home Garden

The growing scarcity and increasing high price of food in the past few years has necessitated the larger production of vegetables by means of the home garden. In April, assistant county agents financed by national emergency funds were placed in four counties of the state to devote their entire time to the home garden project, which was prepared especially for them. The vegetable specialist was in direct touch with these assistant agents, and much time was spent with them in obtaining demonstration gardens, and starting them in the actual work of demonstrating to the children and adults the various necessary steps in obtaining good results from their gardens. The various demonstrations consisted of (1) methods of spading under manure, (2) the application and use of lime and fertilizers, (3) the thorough preparations of the seedbed, the actual sewing of the seeds, showing depth, distance, etc., of planting, (4) the value of companion and succession cropping, (5) the thinning of vegetables, and (6) the spraying for the control of insects and fungous diseases. Later in the fall, demonstrations will be arranged for the storing of the root crops. Placards were printed and are now being placed on the deserving demonstration gardens. The value fo the food taken from the home gardens this year will be very great, and will help to a large extent in solving the problem of food shortage in this state.

Home Production of Improved Vegetable Seed

This country in the past has depended largely upon France, Denmark, Holland and Germany for quantities of various vegetable seeds. Since the outbreak of the present war, this source of supply has been largely cut off, and as a result many vegetable seeds are scarce as well as high in price. In order to meet this shortage it is necessary to educate the gardener, who raises certain crops, to grow and save his own supply of seed. Detailed outlines have been prepared giving instructions as to cultural methods, care of plants, harvesting, curing and storing the seed of twenty of the most important vegetable crops in the state. An outline accompanies each project, giving information as to the selection of mother plants, desirable roots, or desirable fruits which are to be saved for seed purposes. Many of these projects were sent out to interested growers, and as a result much home-raised seed will be saved this year. Another factor which tends to warrant the home saving of seeds is the fact that many of the commercial seeds have not been true to name, have been mixed, and the germination has been poor. The specialist has examined much seed, and has given demonstrations in the selection of tomatoes for seed purposes.

Vegetable Production Without Manure.

The increasing scarcity and high price of commercial manure during the past few years has concerned the vegetable growers very greatly, as they realize that organic matter in the soil must be maintained for maximum production. Successful growers in the state, like Mr. John Middleton, of Sussex County, Mr. E. A. Sexsmith, on Monmouth County, and others, have proven that by proper management a cash crop and a cover crop can be grown on the same ground in the same season. The outlined project suggests various combinations of succession crops, including the time and manner of sewing, quantities of materials to be used in the various mixtures, and suggestions as to the time and manner of plowing under the growth. The results from cover crops of rye and vetch, and of rye alone sown last fall and plowed under this spring, are now showing up very well, and marked increase in plant growth is being obtained. Many cooperators have already been secured in Middlesex-Mercer, Bergen and Passaic counties, na dmuch interest is being manifested by practically all vegetable men.

Blocking Early Plants

Upon the request of County Agent Merrill, this project was outlined for the tomato growers of Bergen County. The object was to demonstrate that by using certain cultural methods in the starting and handling of early plants, labor and material could be saved, and at the same time better plants could be produced to be transplanted into the field for greater production. Six cooperators in Bergen County, one in Sussex County, and one in Middlesex County were secured, and the results in all cases were very marked. The cooperators, as well as their interested neighbors, are convinced of the results, and next year the practice promises to be general in these localities. The blocked plants as compared with the unblocked plants were stockier, had better color, did not wilt when set into the field, had set more fruit, and will bear, on the average, 10 days earlier than the unblocked.

The project has been the most convincing vegetable project completed in North Jersey this year.

Acid Phosphate for Vegetables

Vegetable growers living near cities are able to obtain large quantities of manure cheap. This manure is applied very heavily, and no supplementary commercial fertilizer is used. The object of this demonstration is to show the economic use of acid phosphate on heavily manured soil where fertilizers are seldom used, in promoting earliness and heavier yields of cabbage, cauliflower, sweet corn, cucumbers, eggplants, onions, peppers, peas and tomatoes. In Hudson County the results on early cauliflower were not so marked; differences in color of foliage and in size of plants and flowers were slightly in favor of the acid phosphate plot, but the time of maturity was the same. In comparison with plants receiving nitrate of soda, very little difference could be noticed, the plant growth was not quite so large, but the plants had a better color and matured at approximately the same time. Any effect on the succeeding crops will be observed later in the year. In Bergen County, demonstrations of acid phosphate on late cabbage are being conducted by County Agent Merrill, the results of which will appear in later reports.

Supplemantary Fertilization of Sweet Corn.

In certain sections of North Jersey the production of sweet corn is quite large and important. There seems to be a difference of opinion among the various growers as to the proper time to apply the top dressing of fertilizer, and especially of nitrate of soda. The object of the demonstration is to show the relative effects on the growth of sweet corn of applications of nitrate of soda used as a top-dressing at different stages of growth. A few cooperators in Bergen County were secured; however, it is too early in the season to announce any definite results. In plots examined, the best results so far are in sections receiving the top-dressing when the stalks were 6 to 7 inches high, but these data are not conclusive.

Miscellaneous Demonstrations.

A late tomato variety test is being conducted in Bergen County to determine the difference between mid-season varieties in reference to their tim of maturity, yild, quality, and their adaptability to certain soils. The test includes six of the most popular commercial varieties. The plants are now looking fine, but no results have been obtained because of the earliness of the season.

Cooperators have been secured to demonstrate the value of lime applied to acid soils for the successful growing of maximum crops. Practically all vegetables require a more or less non-acid soil, and the increased yield due to the application of lime is apparent. The fact is also emphasized that a non-acid soil is necessary for the successful growing of a leguminous cover crop.

Seed of the honey-dew melon was distributed to a few expert melon growers in North Jersey. This seeed was planted in plots under glass from three to four weeks prior to planting muskmelon seed in the open; the plants are doing nicely and making good growth. This is the first trial for these melons in North Jersey, and, if the growers are successful in producing high-quality honey-dew melons, a great future will be open to them.

Many tomato growers in North Jersey practice a system of clipping their young tomato plants when from 4 to 6 inches tall. In clipping the young plants, they cut off too much of the leaf surface, and also take off the terminal bud. This results in the sending out of from four to six lateral stems instead of one main stem as in the unclipped plant. When these plants are set in the field, they are not as large, but much stockier, and they also develop a heavier set of early fruit. One cooperator in Passaic County is carrying on a test to determine which is the better method. At present the results are in favor of the clipped plants.

REPORT OF EXTENSION WORK IN FRUIT GROWING

The extension service in fruit growing has been completely broken up during the period from November 1, 1917, to July 1, 1918.

The interruption in the work began early in the previous summer when the extension specialist, Mr. L. G. Gillam, resigned to take up commercial work. Prof. A. J. Farley, associate horticulturist, who has had 10 years' experience in the state, volunteered to give time to the extension service and spent the summer in that work, but beginning in September he again took up his regular teaching work in the college.

Mr. Julian F. Miller was secured to take Mr. Gillam's place, but went to Fort Meyer, Va., to the first officers' training camp and later enlisted in the aviation service.

Mr. Harry Haines assisted the fruit specialist during the spraying season of 1917, but later resigned to enter county work.

During the fall and winter Professor Farley rendered some assistance to the county agents, but his time was limited.

Beginning on May 1, Mr. William McIntyre was secured as assistant specialist, and because of his practical experience was immediately able to meet the numerous requests for advice and counsel in the pruning and spraying of orchards. Two demonstrations in orchard spraying are being conducted by him at this time.

Mr. Van E. Leavit has been secured for the position of fruit specialist and is expected to take up the work July 1.

REPORT OF THE SPECIALIST IN SOIL FERTILITY AND AGRONOMY

J. B. R. Dickey

Starting soon after November 1, much time was devoted to farmers' institute work which continued into March and was followed by a large number of community meetings, etc. Records show that the specialist spoke at 51 meetings, having a total attendance of about 1700. The use of lime, fertilizers, manure and cover crops and the growing of alfalfa, soybeans, corn and other crops were the principal subjects. Charts were used on the first three subjects with good effect in holding the interest and explaining and emphasizing important points. Three sets of mimeographed leaflets were also prepared on these three topics. These gave simple methods of calculating the relative values of different forms of lime, some simple home mixtures of fertilizers and condensed statements of facts and figures which auditors are prone to forget or to confuse unless noted down. Since the farmer will not take notes himself, the idea was conceived of taking the necessary notes for him and of passing these out to all who cared for them at the close of the meeting.

A great deal of time was devoted to the seed corn situation, which was extremely serious. Farmers were urged on all occasions not to neglect to test their seed. As planting time approached and it became more apparent that there was a large amount of seed unfit for use, it was believed that a large proportion of seed to be used was still untested and therefore doubtful. A drive on seed-corn testing in the country schools was therefore undertaken in April. The county agent, one of the boys' and girls' club leaders, or the specialist, visited nearly all the schools in the agricultural sections of importance in six counties, and explained to the pupils the need for testing and simple methods of making the tests, and urged all to make at least a preliminary test of their parents' corn as a measure for increased production. County superintendents, supervising principals and teachers cooperated in this drive in a gratifying manner and in many cases a large number of samples were tested in the school under the supervision of the teacher. In other counties the testing was carried on in a few selected schools and high schools, by the community committeemen and the county agents. The amount of loss saved the state by the detection of poor seed has no doubt been large. A list of farmers having tested seed corn for sale was also prepared and sent out in response to inquiries.

The heavier fertilization of corn as a measure for increased production at a minimum of labor was strongly urged at every opportunity, especially the use of acid phosphate in connection with manure. A large number of demonstrations along this line were started, especially in dairy sections. Some are already showing results.

Two tests of local and semi-local strains and varieties of corn were organized and put in by the specialist in Hunterdon County, and assistance was given the county agents in other counties in securing varieties which should give good yields in tests in their counties. A large number of these variety tests of corn were started or continued from last year. By the elimination from the tests of the low-yielding strains from year to year, and the substitution for them of strains which have yielded well in other localities under similar conditions, it is believed that much valuable data can be secured on the most suitable varieties. To make these tests more accurate the same varieties are tested on at least three different farms in a community. The results of last year's tests are contained in the previous report.

On account of the poor choice of cooperators for many of the 3-year soil improvement projects first started in 1916, and on account of changes of ownership, abandonment of farms, etc., many of these projects have had to be dropped. Lack of sufficient time for proper supervision on the part of the specialist and lack of time on the part of the cooperator for such work have more or less spoiled some of the projects. Work was not done at the proper time, crops were not properly cared for, etc. The cover crops sown last summer and fall were very poor on account of the dry fall and very severe winter.

One fact demonstrated, however, has been that the building up of very poor and very light land, by the use of green manures, cover crops and acid phosphate alone, requires considerable time and, at least at present prices of labor, seeds and materials, is often unprofitable. As a war measure it will be better to concentrate labor and fertilizer on the cultivation and improvement of land already fairly productive.

Three of the plots started in 1916 are now in potatoes, tomatoes or truck. Two started in 1917 are now in corn, and three new plots were started this year where especially desirable locations and cooperators were found. These are now in cowpeas.

Considerable time and assistance has been given to the soil improvement and garden work conducted in the Pines section by the assistant county agent of Burlington County. This work consists in giving some assistance in the way of lime, fertilizer, garden seeds and seed for soil-improvement crops, such as cowpeas and vetch, to deserving families, thereby helping them to get a start toward self-support.

In the fall of 1917 a large illustrated poster in two colors was prepared on the prevention of the waste of farm manure. Copies of this poster were issued and distributed through the county demonstration offices, garages and railroads. An illustrated bulletin on the use of manure was also prepared and issued about the same time. A combination of mailing card and poster on cover crops has been prepared in cooperation with the vegetable gardening specialists and will be mailed out in July. In addition, numerous articles of timely interests on soil fertility and agronomy subjects have been written for the Weekly News Letter and for the county office publications.

A large part of the specialist's time during the summer months has been spent in visiting and advising the county men on agronomy and soil fertility problems and projects, including some oversight and correlation of the work done in various counties on better seed potatoes. An effort has been made to keep the county agents posted on prices and advantageous sources of farm seeds, lime, inoculant, etc. Assistance has been given in planning and carrying out campaigns for the wider and more advantageous use of cover crops, and numerous meetings on this subject have been held and addressed.

In company with the transportation specialist, the specialist in soils went before the Freight Rate Commission in the interest of securing a commodity rate on ground limestone from Buffalo, at which point it could be put on the cars for less than half the price asked by nearby manufacturers. The effort was partially successful.

In addition to the above activities the specialist has made numerous visits in response to requests and has answered a large number of inquiries relative to crops and soil fertility and improvement.

REPORT OF THE SPECIALIST IN POULTRY HUSBANDRY

VICTOR G. AUBRY

At the close of the fiscal year of 1917, when that year's report was made, extension work in poultry husbandry was revised. The outline of the work of previous years had to be changed in order to meet the rapidly changing conditions among poultry keepers, and in order that the extension specialist's work could best be coordinated with that of the county agents.

In last year's report mention was made of the fact that better and more complete records could be obtained if regular monthly reports were substituted for yearly records. This enables the one in charge of such a project to make note at regular intervals of any cooperator who is losing interest or becoming neglectful, and timely assistance or encouragement can be given, thereby maintaining a project which otherwise, in the majority of cases, would be dropped. At the same time, it prevents the cooperator from falling too far behind in his records. This state of affairs was found in previous years to be the cause of a large proportion of the cooperators dropping by the wayside. When yearly reports were asked for, the cooperators often got the idea that they were being neglected or that those in charge had either given up the projects or forgotten about them. The monthly reports have entirely done away with this condition. Although thus far the monthly reports have given a great deal of work to those in charge, the system promises to relieve a great deal of rush work at the end of the year.

MAJOR PROJECT NO. 7—POULTRY FLOCK MANAGEMENT

Because of the earliness of this report, only the records for the first six months of this project can be given. The last six months and yearly records will be made in next year's report.

Cooperators were selected who would follow methods and practices of poultry management as advocated by the Experiment Station. In some cases a poultry-keeper's entire flock was included in the project, and in others only a portion of the flock was used for demonstrations, while the balance of the flock was used for check pens. In some instances it was found necessary to change certain practices to comply best with local conditions of the grain and egg markets, and also with transportation difficulties.

Monthly records were furnished each cooperator on which to report the egg production and selling price of eggs; the amount and cost of mash; the amount and cost of scratch feed, and any remarks pertinent to the project. At the close of each month new record sheets were furnished and the completed records were returned to the county agents, who in turn forwarded these reports to the extension specialist. On the receipt of these reports, the extension specialist made tabulations and figured averages which were written up in the form of a monthly report for the state. Copies of the Monthly State Report were immediately forwarded to each county agent, with a sufficient number of extra copies, so that each cooperator would receive a copy. In addition, two copies were made of each cooperator's report, and returned to the county agent—one for his own files, and one to be returned to the cooperator. The original reports signed by the cooperators have all been placed in the files of the extension specialist. A yearly record has been started for each cooperator in the office of the extension specialist, and each month's tabulations are made on this yearly record from the monthly reports. In unorganized counties, reports are sent directly from the cooperator to the extension specialist.

Occasionally letters were sent to each cooperator, giving him seasonal information, and any new information which was being developed from time to time by the tabulation of the monthly reports, and which could not be incorporated in the monthly state reports; also, fresh information being received in bulletins was included. Besides visits as frequently as possible by the county agents and the extension specialist, the most of the cooperators were given demonstrations on seasonal culling, or the elmination of non-producing hens.

At least one cooperator was selected in each county of the state, and to date, or for the first six months, all counties were reporting but two, viz., Hudson and Mercer. The projects in these two counties were discontinued because severe epidemics of chicken pox made it impossible to make reports.

The following are the figures for some of the more pertinent facts as developed from this project. Because of the lack of space, more detailed reports and minor factors are not tabulated here.

Average Records Per Bird for All Flocks in the Project

Month	Per Cent Production	Price of Eggs	Cost of Feed Per Cwt.	Amount of Feed	Cost of Feed	Returns Over Cost of Feed
1917				lbs.		
November	13.7	$0.73	$3.64	5.68	$0.21	$0.10
December	17.7	.70	3.34	5.91	.20	.12
1918						
January	20.0	.70	3.54	5.66	.20	.16
February	33.0	.63	3.56	6.16	.22	.26
March	51.0	.46	3.70	6.46	.24	.37
April	56.0	.42	3.87	6.76	.27	.33

A summary of the results for the first six months of the project follows:

	Total	Best Record	Second Best Record
Number of cooperators	38	....	....
Number of birds	8,870	171	368
Number of eggs	523,628	12,586	27,461
Per cent production	32.6	40.6	41.6
Total receipts	$23,567.02	$595.68	$1,280.54
Average price per dozen	$0.54	$0.473	$0.456
Amount of mash (pounds)	152,185	....	....
Cost of mash	$5,096.69	....	....
Cost of mash per cwt.	$3.35	....	....
Amount of scratch (pounds)	173,502	....	....
Cost of scratch	$6,516.74	....	....
Cost of scratch per cwt.	$3.75	....	....
Total amount of feed (pounds)	325,687	6,453	14,060
Total cost of feed	$11,613.43	$232.13	$538.41
Cost of feed per cwt.	$3.57	$3.59	$3.80
Total return over cost of feed	$11,953.59	$363.15	$742.13
Amount of feed per bird (pounds)	36.7	37.7	38.2
Cost of feed per bird	$1.31	$1.36	$1.46
Number of eggs per bird	59	73.5	75.1
Gross return per bird	$2.66	$3.48	$3.48
Average return per bird over cost of feed	$1.35	$2.12	$2.02

The amount of interest which has been shown by the cooperators in this project is noteworthy. They have been especially interested in comparing their own report on costs and receipts with the best report each month, and with the average in the state. In many cases the neighbors have taken an active interest in these records.

Everything considered, the idea of monthly reports has been very successful for the first six months, and if the last six months are as successful this project will be enlarged upon next year and more fully exploited.

Minor projects, demonstrations, lectures, etc., have been continued this year, as in normal years, but less time has been devoted to this work. The office work of the extension specialist has increased, but has been more satisfactorily taken care of, because of more efficient arrangements.

Extra new duties, or so-called emergency work, has taken up a great deal of the extension specialist's time.

REPORT OF THE SPECIALIST IN DAIRY HUSBANDRY

JOHN W. BARTLETT

The dairy industry of this state has borne up well under the critical situation of the past year. Feed costs have kept on rising and it has been impossible in some cases to get all of the standard feeds, yet most of New Jersey's dairymen have retained their herds. In some sections the number of cows per herd has been reduced and a few men have gone out of the business, but on the whole the farmers see a bright future ahead.

Because of the unsettled conditions many changes have had to be made in feeding rations, and there has been an unusual demand on the extension division for assistance.

Organization seems to be more and more necessary if the dairy interests are to receive what is due them. The State Dairymen's Association has been active and has accomplished good results. The executive committee was called to Trenton several times to confer with the Animal Industry Committee of the State Department of Agriculture. On May 16, 1918, the state association was reorganized so that every local dairy organization in the state could become a part of the association. The following plan was approved by the old executive committee:

"The president or other representative of each local dairy organization in every county should come together and elect a dairy committee of three members to represent the dairy interests of the county on the executive committee of the county board of agriculture, the chairman of this committee to act as director to the State Dairymen's Association. These directors so chosen should elect an executive committee of seven members from their number."

The association has been so organized with the specialist as secretary, and seven committees have been appointed with one member of the executive committee as chairman of each. The following committees have been appointed: Marketing, Publicity, Organization, State Fair and Farmers' Week, Finances, College and Extension Work. The Marketing and Publicity committee are already working in cooperation with the Bureau of Markets of the State Department of Agriculture.

The work of the past year has been along the same lines as in other years. Dairy record associations should perhaps have first place.

DAIRY RECORD ASSOCIATIONS

Our associations have so far all gone through the crisis without suffering much, if any, loss. It has been a problem to supply cow testers. One new association has been organized in Warren County.

Bergen County

The Bergen County Dairy Record Association was organized in September, 1916. This association is in a locality where all the milk is retailed by the farmers. It was difficult to organize this association, and it has been equally difficult to keep it alive. This association does not have a tester for the full month. It is cooperating with the Burlington County Cow Testing Association; the two counties having one tester. This is possible, not so much because the associations are small, but because in each association there are herds as large as 70 cows. This makes it possible for the tester to complete the work in less time than in associations where the herds average about 20 cows each. Five days have been spent with this association, and one auto tour and one meeting have been held. The number of cows sold as unprofitable during the past year has been 20.

Burlington County

The Burlington County Dairy Record Association was organized during the spring of 1916. Although there were not many members in the association, about 400 cows were pledged. The number of unprofitable cows sold from this association during the past year has been 40. Eighty cows during the year have produced 40 pounds of fat in one month. In this community a cooperative bull association would be of great value.

Cumberland County

The Cumberland County Dairy Record Association was organized in February 17. This, although a small association, has been a very enthusiastic one. The association was reorganized in March of this year and the charge per cow was raised from $1.25 to $1.75. The association tester is sending in to the county agent a report at the end of each week, giving a detailed account of each cow in the association. There were 115 cows which completed a year's test in the association. The average yearly production was 7,358 pounds of milk. Seven cows produced over 10,000 pounds of milk, 15 over 9,000, and 53 produced more than the average. The number of cows sold as unprofitable was 27. The record cow for the year produced 13,384 pounds of milk, and made a profit over feed of $232.00. There are five cows on official test in this county.

Mercer County

The Mercer County Dairy Record Association was organized in May, 1917, with 20 members. At the present time this association has been reorganized on the basis of $2.25 per month for each member. This association, during the year, has held 7 meetings. Fifty-six cows have produced 40 pounds of fat in one month during the past year. The tester was instrumental in getting a pure-bred bull for two members of the association. He has balanced rations and figured out feeding methods for 12 men in the association. The high cow for the year produced 11,022 pounds of milk and 285 pounds of fat, with the profit above feed of $220.00. The lowest cow gave 3,294 pounds of milk, 118 pounds of fat, and made a profit above feed of $14.90.

Middlesex and Somerset County Association

This association was the first one in the state to be organized on the basis of $2.00 per month per member. It has proved to be a very good way to organize. This association, when first organized, was situated in a retail milk section, and when the prices of feeds began to soar several herds were sold. In getting new members for the association it was much easier to solicit membership on the basis of $2.00 per month than so much per cow. There were several farmers in this association who have had very good results from the work of the cow tester. In two instances during the past year the feed bill for the month has been cut in two. One factor which has proven very valuable to the members of the association is that the tester's figures are a check on the creamery test. The number of cows producing 1,500 pounds of milk in a month during the past year has been 30, and the number of cows producing 40 pounds of fat has been 93.

Salem County

Of the 27 herd bulls in this association all are reported as pure-bred. There are 18 cows on official test. Ninety-eight cows have been sold during the year as unprofitable.

Following are some data as to the relative value of the cow-testing association records; showing the first year's record as compared with that of the second year, both in the whole association and with some of the members.

	No. of Herds	No. of Cows	Milk Produced During Testing Period	Fat Produced During Testing Period	Value of Product	Cost of Roughage	Cost of Grain	Total Cost of Feed	Profit Over Feed Cost
Total for the Association:			lbs,	lbs.					
First Year....	13	364	2,129,240	83,607	$40,379.45	$12,942.84	$10,056.14	$22,998.98	$17,380.47
Second Year..	13	347	2,096,005	81,181	42,596.01	11,765.52	8,288.80	20,054.32	22,541.69
Average per cow:									
First Year....	13	28	5,849	229.6	$110.90	$35.55	$27.62	$63.12	$47.78
Second Year..	13	26	6,040	233.9	114.76	33.90	23.90	57.80	56.96
Gain of second year over first year..	..	...	191	4.3	$12.30	$1.65	$3.72	$5.32	$9.18

	No. of Cows	Milk Produced During Testing Period	Fat Produced During Testing Period	Value of Product	Cost of Roughage	Cost of Grain	Total Cost of Grain	Profit Over Feed Cost
Herd D		lbs.	lbs.					
First Year	54	7283	354	$131.63	$36.13	$40.02	$76.18	$55.45
Second Year	54	8552	322	156.71	38.53	37.46	75.99	80.72
Gain of second year over first year	..	1269	—32	25.08	2.37	2.56	.19	25.27
Herd E								
First Year	20	5670	205	$112.08	$39.15	$25.05	$64.20	$47.78
Second Year	17	6607	281	163.74	34.33	18.68	53.01	110.73
Gain of second year over first year	..	937	76	50.66	4.82	6.37	11.19	62.95

Sussex County

Thirty-three cows have been sold as boarders during the year; 305 cows have given over 40 pounds of fat in one month and 4 cows have been on official test. It is interesting also to note that every dairyman in the association feeds silage.

Walkill Valley

The Walkill Valley Dairy Record Association, situated in the northern part of Sussex County, is an association which seems unlike any other one in the state. The farmers expect and are willing to take a great deal of advice from the tester. In this association the tester is sending in to the county agent's office a detailed report of each cow tested for the month. The county agent files these reports and writes a personal letter to each member of the association confirming the advice of the tester. Several meetings of this association have been held during the past year and the program taken up has been along the lines of the value of records and the value of cooperative bull associations.

Warren County

The Warren County Dairy Record Association was organized in May, 1918. This association has not been operating long enough to make any report other than that the members are well satisfied with the first month of the test. There are 13 members in the association, owning 310 cows.

Herd Records Other Than Those of Cow-Testing Associations

Feeding Demonstrations

Throughout the fall of 1917 and the winter of 1918 several farmers were induced to keep records of milk production and feed according to the amount of milk produced. In some instances records were kept before and after the ration was changed. As a result of these records one man has sold 12 cows as boarders.

Following is an account of the results of records on one farm:

Record of Milk Production During Feeding Demonstration Carried on at the Farm of John Frostick, Farmingdale, N. J., in cooperation with Mr. Ellwood Douglass, Superintendent of Farm Demonstration for Monmouth County.

Length of Demonstration—Two 10-day periods.

Old Ration:
110 lbs. dried brewers' grains.
100 lbs. molasses feed.
100 lbs. Big Q dairy feed..................Cost per 100 lbs. $2.95
4 bundles stalks....................................@ .05
10 lbs. hay ....@ 32.00

New Ration:
500 lbs. corn and cob meal.
300 lbs. dried brewers' grains.
200 lbs. cottonseed meal ....Cost per 100 lbs. $2.97
100 lbs. oil meal.
25 lbs. mixed hay.......................................@ 32.00

Total feed consumed during periods of demonstration:
Period I
(Old Ration) 800 lbs. grain, 540 lbs. hay, 240 bdls. stalks.
Period II
(New Rations) 480 lbs. grain, 1,500 lbs. hay; no stalks available.

Total amount of milk produced during periods of demonstration:
Period I—407 quarts.
Period II—520 quarts.

Increase or decrease in milk flow:
113 quarts increase.

Increase or decrease in cost of feed consumed:
$5.00 decrease.

Cost of producing quart of milk:
1st period $0.10+
2nd period $0.07.

Profit or loss as result of demonstration:
$8.47 in milk + $5.00 = $13.47 profit.

The cost of hay during the second period of the demonstration caused the high cost per quart of milk.

BULL ASSOCIATIONS

Six meetings have been held during the last few months for the purpose of arousing interest in bull association work. Two were held in Mercer County, one in Somerset and three in Sussex.

An actual canvass will be started after July 1 to organize such an association in Mercer County. There is a great field for such an association in that section.

CALF-FEEDING WORK

The use of the home-mixed calf meal has been advocated throughout the state. Instructions as to mixing and feeding the calf meal have been furnished to 18 dairymen. Records of costs of grain were kept a year ago. At the present time there are no demonstrations, with farmers, far enough advanced to give any figures where calves have been fed on feeds at present prices. The calf meal is composed of oil meal, hominy, Red Dog flour and dried blood flour mixed in equal parts by weight. Fifty-one boys and girls are keeping accurate records as to the cost of growing calves to one year of age. Following is the report of one of the club members:

Month	Feed Fed				Cost of Feed per Month	Gain pounds	Cost of Gain per pound
	Milk quarts	Calf Meal pounds	Grain pounds	Hay pounds			
December	90	8	10	30	$7.53	35	$0.21 4/5
January	15	15	60	60	4.56	45	.10 1/7
February	None	15	90	90	4.86	44	.10 4/5
March	None	None	105	105	4.72	60	.07 7/8
April	None	None	105	120	4.95	40	.12 3/8
May	None	None	120	Pasture	5.00	41	.12 1/4
Total	105	38	490	405	$31.62	265	

Weight of calf at birth	80	pounds
Weight of calf at end of 6 months	345	pounds
Gain for 6 months	265	pounds
Gain per day	1.42	pounds
Cost per pound of gain	11.9	cents

Cost of Milk Production

Blanks for the study of the cost of milk production have been put into the hands of the cow testers in some localities. The testers, with the assistance of the county agents, will carry these out with the farmers. This work is done in cooperation with the Bureau of Markets of the State Department of Agriculture.

Cooperative Work With Director of Institution Farms

The specialist in dairying is cooperating with the director of farms at state institutions, and is visiting herds at 8 state institutions each month. A uniform herd book has been adopted; a daily report of herdsmen has been put in use; 3 pure-bred bulls have been chosen as herd sires; 6 of the herds have been tested for tuberculosis; calves are being fed on the home-mixed calf meal; 2 cow testers have been placed as institution herdsmen; a uniform breed of cattle has been adopted (Holstein seems best adapted); a record blank for all tuberculosis temperatures has been added to the herd books and a calving table will be put in when printed. Plans are now under way for a cooperative bull association among institutions.

Boys' and Girls' Dairy Club Work

The specialist in dairying is cooperating with the state club leader in dairy club work. Fifty-one boys and girls are each raising a calf according to rules and instructions made out by the specialist. The instructions are sent out monthly, giving information about caring for calves at various ages. A complete set of instructions has been compiled. Each member of a club is keeping an accurate record of all feed fed and the cost of a pound of grain with each calf.

An elementary course in milk production has been given in monthly talks to the club members. The judging of dairy cattle is now being taken up and all time will be spent on that until the contest at the Inter-State Fair in the fall. Members have done milk testing in the schools and have started records at home.

This coming year much effort should be put in the organization work. A few more dairy record associations should be formed. In order to strengthen the work of the tested a testers' conference should be held at least two times each year at the College. The dairy clubs have proved a decided success. They should be organized in all the dairy counties.

A statistical report for the year shows:

Meetings addressed	36
Attendance	1201
Farms visited	344
Letters written	747
Circular letters mailed	772
Meetings attended	43
Attendance	1350

REPORT OF THE
DEPARTMENT OF AGRONOMY
AND FARM MANAGEMENT

Department of Agronomy
and
Farm Management

FRANK APP, B. S., *Agronomist*

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Report of the Department of Agronomy and Farm Management

FRANK APP

The department of Agronomy and Farm Management has been seriously handicapped during the past year because of insufficient assistance, and because of the large demand upon the time of the agronomist for emergency work.

The activities of the department may be summarized as follows:

Field Crops

A. The Proper Source of Alfalfa Seed for New Jersey.
B. Time of Seeding.
C. Alfalfa Cultivation.
D. Sweet Clover Seeding.
E. Selecting of Ensilage Corn.

Farm Management

A. Study of New Jersey Poultry Farms.
B. Study of Monmouth County Truck Farms.
C. Study of Cost of Milk Production.
D. Study of Cost of Egg Production.

Emergency Work

A. Farm Labor.
B. Alfalfa.
C. State Corn Show.
D. Miscellaneous.

FIELD CROPS

The Proper Source of Alfalfa Seed for New Jersey

The source of seed for this work was reported in 1917. Suffice it to say that from the 35 cooperators, we do not have, at this time, complete returns for the first cutting. The alfalfa went into the winter very small, but, up to date, most reports show that it has come through in satisfactory condition. There has not been any marked difference in these strains up to date. It is still too early to expect great differences.

One interesting fact was brought to the attention of the agronomist this past year. One of the cooperators from Cumberland County placed the plots in a field of alfalfa. The seed purchased by the farmer was obtained through local dealers, and was said to come from Kansas. Last fall it came up and made a very rank growth, outstripping the seed from any of the plots of the Experiment Station. This spring the entire field seeded by the farmer had died out, whereas the strains seeded by the Experiment Station were strong and thrifty, showing that they were able to stand the winter quite successfully. Had it not been for these plots, the farmer would have been discouraged with alfalfa and felt it was not a practical crop for him to grow, but because of this seed from the Experiment Station, he realized, and his neighbors realized, that a large part of the success of alfalfa depends upon the proper source of seed. The farmer's seed probably was not from Kansas.

Time of Seeding

For most conditions the time of seeding that will give the best success is late summer or August. Last year the most successful area seeded in the experimental plots on the College Farm were those seeded in August, without a nurse crop, and those seeded in the latter part of March with wheat as a nurse crop, whereas in the plots seeded April 11 and June 7 without a nurse crop, the alfalfa was almost entirely choked and smothered by the weeds.

On a portion of the College Farm where the seed was put into a seed-bed which was quite dry and the seed was not covered deep enough so that it reached the damp soil, the germination was late, and the plants were very small. These plots did not come through the winter successfully, because they were too young to stand the severe cold weather. This case emphasized again the absolute necessity of having a well prepared seed-bed, and of putting seed down deep enough to reach damp soil, so as to afford prompt germination and give a strong healthy plant before winter.

Alfalfa Cultivation

The project on alfalfa cultivation has been discontinued because the plots became very thin and are being over-run with grass. While the cultivation assisted in holding the alfalfa on a heavy clay loam soil, yet it did not prove practicable and did not give as large a yield as when seeded solid. The plot which was seeded with alfalfa and timothy proved the most satisfactory for heavy clay loam soils.

Sweet Clover Seeding

The sweet clover which was seeded with wheat as a nurse crop in 1916, gave a very rank growth in 1917. It was allowed to go to seed in order that it may be seen whether it would reseed itself, but it has not done so. While there are small areas in the plot which are heavily reseeded, on the whole, it is almost completely over-run with weeds. On the other hand, the agronomist has seen some areas in the state which have reseeded themselves successfully.

Selection of Ensilage Corn

There is nothing further to report on the selection of ensilage corn at this writing.

FARM MANAGEMENT

Study of New Jersey Poultry Farms

A study of New Jersey Poultry Farms has been completed and was placed in the hands of the director, on March 15, 1918. The following is the summary of the findings:

1. New Jersey has some marked advantages pertaining to the poultry industry, especially with respect to markets, climate, soils, and an established business of much reputation.
2. The poultry areas of New Jersey are devoted almost exclusively to poultry raising without any other line of agriculture important in their area.
3. Four poultry associations, branches of the state association, flourish in these poultry areas.
4. The flock practice of these commercial poultry farms is quite uniform
5. Yearlings are largely kept every winter as breeders for the production of hatching eggs.
6. Eggs are carefully sorted and those of medium size and uniform shape are used.
7. Most of the hatching is done by incubators having a capacity of 360 to 400 eggs.
8. Culling of the chickens begins immediately after incubation, and before they are placed in the brooder.

9. Small chicks are fed four times a day the first week, three times the second two weeks, and twice a day thereafter.

10. The most common type of brooder house is one 14 to 20 feet in width, and long enough to care for the desired number of chicks.

11. Colony brooder houses are largely used on the newer poultry plants.

12. Few hens are kept after they are 2 years old.

13. Most young cockerels are separated from the rest of the flock as soon as distinguishable, which is four to five weeks after hatching.

14. The number of pullets and old hens in these flocks on November 1 is considered the size of the flock for the year.

15. The majority of the poultrymen buy their grains separately and mix them. The ration used is largely that recommended by the New Jersey Agricultural Experiment Station.

16. The ranges for the Poultry occupy 3.2 acres per farm, or over 27 per cent of the total farm area.

17. White Leghorn fowls comprise 94.3 per cent of the total number on these farms.

18. The operators of these poultry farms received from products other than poultry, largely fruit, an average of $62 per farm.

19. The farms were all occupied by owners.

20. The labor income for the 150 farms was $730, almost $1.00 per hen.

21. The average capital per farm was $7,243.

22. The largest capitalized farms yielded the largest profits.

23. The rate of income returned on investment was 15.1 per cent.

24. The average size of these flocks was 737 fowls, of which 720 were hens and 17 cockerels.

25. The largest flocks gave the largest profits per farm.

26 The largest flocks were the most economical to operate.

27. The building investment was $1.54 per bird.

28. The amount of the receipts above expenses, not including the operator's labor, was $1.48 per bird.

29. The egg production per hen was 109 eggs for the year.

30. The current expense per hen was $2.34.

31. The receipts per bird were $3.82.

32. It required 1.9 months' labor of one man to care for 100 birds and the proportion of chickens raised per year.

33. The flock having the highest production showed the greatest profit for the year.

34. Eleven per cent of the flocks had a production of 45 per cent above the average for the 150 farms.

35. Experience was quite necessary to success on these poultry farms.

36. The poultrymen on these farms engaged in many different lines of work prior to entering the business.

37. The proper proportion of pullets to yearlings was 50 to 70 per cent of the number of the flock.

38. The size of the land area per flock did not appear to affect the egg production, or the number of deaths in the flock.

39. The depreciation of pullets was 29 per cent and of yearlings 50 per cent, while the depreciation of a pullet until she was sold as a two year old was 64 per cent.

40. The cost of producing eggs in 1916 was 29.3 cents per dozen.

41. The amount of feed required for the laying flock and young stock was 82.97 pounds per hen.

42. The amount of labor required for the laying flock and young stock was only 1.77 months of one man's time per 100 birds.

43. The profit per hen on 100 farms was 41 cents.

44. The major factors essential for success on these poultry farms were found to be: size of flock, egg production per hen, experience of operator, and proportion of pullets to yearlings.

45. The two most essential factors were size of flock and production per hen.

46. Farms on which the production and size were above the average yielded a labor income of $2,002. those with only size or production as good as or better than the average gave only $659, and those with neither size nor production as good as or better than the average gave a labor income of only $106.

Study of Monmouth County Truck Farms

The data from these farms have been completely tabulated, but the writer has not had the opportunity to study them for publication.

Study of the Cost of Milk Production

The agronomist is cooperating with the State Department of Agriculture and the dairy department of the experiment Station to continue work on the cost of milk production through the cow testing associations. The value of this work, however, can not be obtained until a year from now, since it is contemplated that records will be kept of all the labor, feed and other expenses entailed in the production of milk by the individual farmer in the cow testing association.

Study of the Cost of Egg Production

This has been arrived at through the records obtained in the poultry survey. They are very complete and have been studied with respect to the amount of labor and materials necessary for egg production, allowing the current price to be placed on such labor and materials, so that the present cost of producing eggs may be determined.

MISCELLANEOUS AND EMERGENCY WORK

Farm Labor

The *agronomist has published a bulletin on Farm Labor after studying the situation in this and other states. This is one of the most serious problems confronting the farmer at this time. The remedy does not appear in any form of a new supply, but rather a more efficient use of the present labor on the farms. Labor could be made more efficient by the use of more and better machinery, by driving larger teams, and by better planning on the farm, and by doing the work at the most opportune time. The agronomist has kept the county agents informed of all the available sources of labor within the state, so that any possible supply would be known to the farmer.

Alfalfa

Through information obtained from work over the state, the farmers have been acquainted with the fact that it is highly essential that alfalfa seed be purchased from known sources of the seed-producing states. Through this information, the agronomist knows that at least approximately one carload of alfalfa seed has been ordered direct from the producer or a representative of known integrity. Many of the dealers in the state are taking more careful pains to get seed from certain seed-producing states. This most assuredly will assist in placing the alfalfa industry on the farm on a more staple basis As secretary of the Alfalfa Association, and chairman of the committee for the grading of alfalfa hay, the agronomist has assisted in making definite rules and recommendations for the grading of alfalfa hay grown under eastern conditions. These rules will be given consideration by the Hay Association at its annual meeting in July. If adopted and put into force, it will greatly facilitate the marketing of this crop in New Jersey.

State Corn Show

At the request of the Secretary of Agriculture, the agronomist acted as manager of the State Corn Show held at Trenton during Farmer's Week last January. This was the first state corn show to be held in New Jersey and proved a decided success. A creditable display was made and a number of very high class exhibits were entered It is hoped that this good work will continue to the interest of better corn in the state.

NEEDS OF THE DEPARTMENT

These are about the same as mentioned in the preceding report and need no further elaboration here. Because of present labor shortage and war conditions, it does not seem advisable to add to the present duties.

On May first the agronomist was temporarily appointed state leader of farm demonstration.

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*Farm Help Specialist, U. S. Dept. Agr.

Statement of Progress in Agronomy Department and money spent for work by the Station during fiscal year, November 1, 1917 to July 1, 1918.

FARM MANAGEMENT

Study of New Jersey Poultry Farms completed and manuscript placed in the hands of the Director, March 15, 1918.

Study of Monmouth County Truck Farms—tabulation completed.

EXPENSES FOR FARM MANAGEMENT WORK

Tabulating records	$138.70	
Salary of staff	50.00	
Total	$188.70	

MISCELLANEOUS EXPENSES OF DEPARTMENT

Stenographer	360.00	
Traveling and incidentals	151.47	
Total	$511.47	
Farm Management		$188.70
Miscellaneous		511.47
Total		$700.17

REPORT OF THE DEPARTMENT OF SOIL CHEMISTRY AND BACTERIOLOGY

Department of Soil Chemistry and Bacteriology

JACOB G. LIPMAN, PH.D., *Soil Chemist and Bacteriologist.*
AUGUSTINE W. BLAIR, A.M., *Associate Soil Chemist.*
*HARRY C. MCLEAN, PH.D., *Chemist and Bacteriologist, Soil Research.*
CYRUS WITMER, *Field and Laboratory Assistant.*
†JOSEPH R. NELLER, M.S., *Research Assistant.*

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* On State Station.
† Resigned November 15, 1917, to enter military service.

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Report of the Department of Soil Chemistry and Bacteriology

JACOB G. LIPMAN
AUGUSTINE W. BLAIR

On account of the change of date for the ending of the fiscal year, the report for the period November 1, 1917, to June 30, 1918, is necessarily short. It is not possible to include certain data which have been included heretofore for the reason that the results are not complete until the crops have been harvested and samples analyzed.

During the period covered the following persons have withdrawn from this department to enter other service: Mr. R. E. Curtis, to teach in the Rutgers College Short Courses and to direct the farm tractor service; Mr. J. R. Neller, to enlist in the Aviation Service of the United States Army; Mr. C. S. Lamson, to join an Ambulance Unit in the Army; and Mr. William Whynman, to enlist as yeoman in the Navy.

The following appointments have been made: Mr. Sidney Carroll, March 15, teamster, and Mr. Cryus Witmer, field and laboratory assistant, April 1.

EXPERIMENTS ON THE AVAILABILITY OF NITROGEN IN DIFFERENT MATERIALS

The forty field plots are now in corn, this being the first year of the third five-year period. The early spring permitted early plowing and consequently the corn was planted in good time and is now in fine condition. Already there are some very pronounced differences due to difference in nitrogen and lime treatment and these differences will undoubtedly be emphasized within the next two months.

The limed sulfate of ammonia plot is making normal growth and compares favorably with the plot that receives nitrate of soda at the rate of 320 pounds per acre, while the corresponding unlimed plot is of a pale yellow color, very small and making little growth. The continuously unfertilized plot without lime is also very small and is almost at a standstill so far as growth is concerned. The plots which receive minerals only are making fair growth but are distinctly inferior to the nitrate of soda plots. The plots making the best appearance at this time are those that receive manure or manure and nitrate.

No potash was applied to these plots this year since it was believed that the heavy applications which have been made regularly for the past ten years would leave in the soil a residue of this material quite sufficient for the corn crop. Furthermore, this soil naturally contains a fair amount of potash and so far there is very little evidence to indicate that potash materially increases the yield of such crops as corn, wheat, oats and hay on this type. Other fertilizing materials were applied in accordance with the original plan and the plots designated as 1-B to 20-B received an application of ground oyster shells at the rate of two tons per acre. Before applying lime and fertilizers, samples of soil were collected for analysis.

The cylinder experiments on the availability of nitrogenous materials are progressing in a very satisfactory way. Sixty of these, known as *Group L* are also in corn, this being the first year of the fifth five-year period, that is, the twenty-first year of the work. Samples of soil were collected before fertilizers were applied and these are being analyzed for nitrogen and carbon.

Where commercial nitrogenous materials are used as the only source of nitrogen, the lime treatment is giving very pronounced results, but where cow manure is used, either alone or in combination with commercial nitrogenous materials, the need of lime is not so pronounced. The sulfate of ammonia cylinders show results very similar to those noted in the field experiments.

A partial summary of this work covering a period of twenty years—1898 to 1917, inclusive, has been published in "Soil Science" for April, 1918.

EXPERIMENTS ON THE ACCUMULATION AND UTILIZATION OF NITROGEN

The twenty-eight lime and rotation plots are in corn this year, this being the beginning of the third rotation period. Ground limestone was applied in accordance with the original plan. No potash was applied for the reasons given under nitrogen availability experiments. Before applying the lime and fertilizers, samples of soil were collected for analysis.

The corn so far has made excellent growth, but no very pronounced results due to lime treatment are apparent.

The continuous corn experiment, with a legume and a non-legume green manure crop and the wheat and rye with and without a leguminous green manure crop are being continued. The wheat and rye were somewhat injured during the cold weather but the yield will be fair.

The cylinder experiments on the accumulation of nitrogen by means of leguminous green manure crops are being continued as heretofore, this being the twelfth year. The green manure crops were practically all winter-killed and consequently the cylinders which are supplied with nitrogen in this way are, with few exceptions, not up to their normal condition. Although there has been a rather unusual amount of rain, the crops in the nitrate of soda cylinders are for the most part good.

The rye which was seeded last fall was so badly injured by the cold weather of 1917-18 that it was thought best to turn it under and plant these cylinders to barley. This was done and a very satisfactory crop has been harvested. The oat crop also is good. With few exceptions the corn and potatoes are showing the effects of nitrogen hunger.

GYPSUM AND IRON SULFATE EXPERIMENTS

(Plots 73-80)

The results so far secured on these plots do not seem to justify the continuation of this experiment in accordance with the original plan, and it has been decided to make a change in both the rotation and the fertilizer treatment. The proposed changes are such as will allow this work to be correlated with the nitrogen-accumulation work and also with the potash availability work that is now being carried on.

The eight plots have been divided into two sections of four plots each; plots 73 and 75, and 77 and 79 constituting a non-legume section and 74 and 76, and 78 and 80 constituting a legume section. Two plots in each section (75 and 79 in the non-legume section, and 76 and 80 in the legume section) will receive muriate of potash at the rate of 50 pounds per acre annually. The other two plots in each section receive no potash. The rotation will be as follows:

1918—All plots in corn (winter vetch on legume section).
1919—All plots in oats, followed by buckwheat on no-legume section and soybeans on legume section, as green-manure crops.
1920—All plots in wheat.
1921 and 1922—Two plots in each section in timothy, and two plots in each section in timothy and clover

The corn this year is in excellent condition and so far is very uniform in growth.

The plots which have been designated as A, B, C and D, are also to be correlated with the nitrogen-availability work the rotation to be

A and B (Duplicate)	C and D (Duplicate)
Corn—(rye)	Corn (winter vetch)
Potatoes	Potatoes
Rye	Rye and vetch—soybeans
Timothy (2 years)	Timothy and clover (2 years)

ALFALFA EXPERIMENTS

The plots designated as E, F, G and H have been in alfalfa since August, 1913, this making the fifth harvest year. The yield from the first cutting is less this year than for any previous year. The heaviest yield was from plot H, which received limestone at the rate of 4,000 pounds per acre; and the lowest yield was from the check plot which received no limestone. No lime had been applied since the seeding in 1913, and consequently weeds and grass are coming in over much of the area; this accounts, in a large measure, for the decreased yield. The plot receiving the heaviest application of limestone is least infested with weeds. The comparative yields on the acre basis from the *first* cutting for the five years are as follows:

PLOT	1914	1915	1916	1917	1918	Average	Treatment
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
E, ...	2350	1625	2400	2125	1440	1988	No lime
F, ...	1925	1960	3120	2720	1508	2249	1000 lbs. ground limestone per acre
G, ...	1600	2260	3260	2060	1852	2206	2000 lbs. ground limestone per acre
H, ...	2000	2850	3325	2775	2120	2614	4000 lbs. ground limestone per acre

POTATO FERTILIZER EXPERIMENTS

The cooperative fertilizer experiment at Elmer is being carried on again this year. The fertilizer treatment is practically the same as last year, though the plots which received marl last year received no further marl treatment this year, the aim being to note the residual effects of the marl.

Already there are pronounced differences in appearance and growth, but these are only suggestive; the real test must come when the potatoes are dug. It is recommended that this work be continued another year.

OTHER WORK

Variety tests with soybeans on limed and unlimed plots are being carried on again this year, this being the sixth year that beans have been grown on this soil without intermission. Eighteen varieties are under observation.

Certain plots receive ground oyster shells at the rate of 2 tons per acre, while other plots receive no lime. The effect of the lime treatment could be noted when the beans were only two or three weeks old and it becomes more pronounced as they advance.

The work on the oxidation of sulfur in the soil, and its subsequent solvent action on rock phosphate has been continued both as a problem at this station and as a cooperative project with a number of other experiment stations.

During the year about 100 samples of soil which were sent in by a party of the United States Soil Survey, working in two different areas, have been analyzed, and also a number of miscellaneous samples of soil and marl have been examined and reported on, in addition to something like 2,000 crop samples that have been analyzed in connection with the field, cylinder and pot experiments.

Two bulletins have been issued as follows:

No. 316. The Influence of Lime Upon the Yield of Dry Matter and Nitrogen Content of Alfalfa.
No. 323. The Value of Nitrate of Soda in Crop Production.

A third bulletin, "The Chemical Composition of the Soils of the Camden Area" has been prepared and is now ready for publication.

In addition to these bulletins two or three articles bearing on the work of the department have been published in "Soil Science."

THE INFLUENCE OF BACTERIA CARRIED IN MANURE ON THE DECOMPOSITION OF LEGUMINOUS AND NON-LEGUMINOUS GREEN MANURES

This work has been in progress for ten years and an account of the first five years was given in the Annual Report for 1912. The later accounts, with the exception of this one (season of 1917), have appeared in the annual reports for the respective years.

The experiment has as its object a study of the influence of the bacteria carried in cow manure on the decomposition of green-manure crops that have been plowed under. The quantity of manure is purposely kept small in order that the influence of the fertilizing constituents contained in the manure may be reduced to a minimum. The experiment also contemplates a comparison of leguminous with non-leguminous green manure crops in the continuous growing of corn.

Plan of Experiment

The plots are one-twentieth acre in size. The soil is a loam to gravelly loam and is especially deficient in nitrogen. When the experiment was started in 1908, ground limestone was applied at the rate of 1 ton per acre and a second application of 2 tons per acre was made before planting the corn in 1913. Each plot receives annually 8 pounds of nitrate of soda, 15 pounds of acid phosphate and 5 pounds of muriate of potash. (During the first five years of the experiment no nitrate of soda was applied).

The cow manure and green manure treatment is as follows:

Plot 49—Corn followed by vetch and crimson clover as green manure, no cow manure.
Plot 50—Corn followed by vetch and crimson clover as green manure, 50 lbs. manure.
Plot 51—Corn followed by vetch and crimson clover as green manure, 100 lbs. manure.
Plot 52—Corn followed by vetch and crimson clover as green manure, 200 lbs. manure.
Plot 53—Corn followed by rye as green manure, no cow manure.
Plot 54—Corn followed by rye as green manure, 50 lbs. cow manure.
Plot 55—Corn followed by rye as green manure, 100 lbs. cow manure.
Plot 56—Corn followed by rye as green manure, 200 lbs. cow manure.

The manure is spread broadcast before the green manure crop is plowed under in the spring.

The cover crops were seeded in the usual way in 1916 and made a good growth during the fall; though most of the crimson clover was winter-killed. The vetch lived through the winter but made very little growth in the spring previous to the time of plowing the plots. The rye on plots 53-56 made a good growth, being about ten inches high at the time of plowing under on May 8. Before plowing the plots, manure was spread in accordance with the plan as outlined above. After plowing, the plots were fitted, and the fertilizer applied, and on May 23 corn was planted, the rows being 40 inches each way, giving 200 hills per plot. During the season the corn was given the usual cultivation and hoeing, the growth and general conditions being satisfactory. The corn on the legume section was of a darker color than that on the non-legume section, thus distinctly showing the effect of the additional nitrogen furnished by the legumes.

Early in August the cover crop for the next year was seeded as follows:

Plots 49-52—A mixture of alsike, red and crimson clover, alfalfa and winter vetch.
Plots 53-56—Rye.

Table I

Yield of Corn With a Legume and a Non-Legume as Green Manure

(Calculated to Acre Basis)

No.	TREATMENT	Grain			Stalks			Cobs				Increase over check		
												Dry Matter		
		Dry Matter	Nitrogen	Nitrogen	Dry Matter	Nitrogen	Nitrogen	Dry Matter	Nitrogen	Nitrogen	Total Nitrogen	Grain	Stalks and Cobs	Nitrogen
		LEGUME SECTION												
		Lbs.	%	Lbs.	Lbs.	%	Lbs.	Lbs.	%	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
49	No manure,	2160	1.282	27.691	2880	.529	15.235	483	.375	1.811	44.737	.....	.....	....
50	50 lbs. manure per plot,	2440	1.340	38.696	2720	.769	20.917	504	.356	1.794	61.307	280	.....	16.570
51	100 lbs. manure per plot,	2320	1.330	30.856	2720	.759	20.646	464	.394	1.828	53.330	160	.....	8.593
52	200 lbs. manure per plot,	2280	1.436	32.741	2680	.875	23.450	459	.519	2.382	58.573	120	.....	13.836
	Average,	2300	1.347	32.496	2750	.733	20.062	478	.411	1.954	54.487	187	.....	13.000
		NON LEGUME SECTION												
53	No manure,	1600	1.272	20.352	2200	.607	13.354	350	.327	1.145	34.851	.....	.....	....
54	50 lbs. manure per plot,	1800	1.253	22.554	2520	.634	15.977	373	.548	2.044	40.575	200	343	5.724
55	100 lbs. manure per plot,	2000	1.214	24.280	2520	.836	21.067	414	.356	1.474	46.821	400	384	11.970
56	200 lbs. manure per plot,	1640	1.330	21.812	2600	.740	19.240	325	.538	1.749	42.801	40	375	7.950
	Average,	1760	1.267	22.300	2460	.704	17.409	366	.442	1.603	41.262	213	367	8.548

Of the legumes on plots 49-52, only the vetch came up and grew. The rye on plots 53-56 did well. The corn was gathered and shocked early in October and after drying for a few weeks was husked and one-twentieth of the whole was taken as a sample. These samples were dried and prepared for analysis in the usual way. The results of the season's work are shown in table 1.

The Influence of Manure

From a study of the table it is at once apparent that the manure has had a decided influence upon the yield of grain and total nitrogen recovered. It is to be noted, too, that with only one exception (cobs on Plot 50) the percentage of nitrogen in the grain, stalks and cobs was higher from the manured plots than from the check plot of the legume section, and from the non-legume section it is also higher in the stalks and cobs from the manured plots than from the check plot. Thus it follows that the total nitrogen for each of the manured plots exceeds the total nitrogen for the corresponding check plot.

Since the amount of manure applied is small in comparison with that applied in farm practice, and since the increases in yield are not always directly proportional to the amount of manure applied—the greatest increase in some cases being with the smallest amount of manure—it does not appear that this increase can be attributed entirely to the fertilizing constituents contained in the manure.

It would therefore seem that the manure has a value aside from the fertilizing constituents which it contains, and even aside from the organic matter as such.

Thus far bacterial counts have not been made, but there is good reason to believe that the organisms introduced by means of the manure do stimulate the decomposition of the green-manure materials and thus furnish to the crops on these plots more available nitrogen than is furnished to the crop on the check plots. During the ten years that this work has been in progress the results, with slight exception, have been in favor of the manure as described above.

The Legume and the Non-Legume Compared

The yields on the legume section are without exception greater than the yields on the non-legume or rye sections. The average yield of grain on the legume section is 2300 pounds, while the yield on the non-legume section is 1760 pounds, giving a difference of 540 pounds, or nearly ten bushels, in favor of the legume section. Again, the average amount of nitrogen recovered from the legume section is 54.5 pounds, whereas the average amount recovered from the non-legume section is 41.3 pounds, the difference in favor of the former being 13.2 pounds.

In some cases the increases on the treated plots over the check plot in the legume section are not so great as the increases in the non-legume section. This is undoubtedly due to the fact that there is not so much difference between the check and the treated plot in the legume section as in the non-legume section; that is, in the legume section the check has the advantage of the nitrogen supplied by the legume, whereas in the non-legume section the check plot has no such advantage.

The superiority of the legume over the non-legume as a green-manure crop is here distinctly shown.

THE INFLUENCE OF LIME UPON THE YIELD OF DRY MATTER AND NITROGEN FROM DIFFERENT VARIETIES OF SOYBEANS

Variety experiments with soybeans on limed and unlimed plots were started in 1913, and these have been continued each year on the same plots without intermission, this report being for the fifth crop, and for the season of 1917.

The soil is a loam of fair quality. In 1908 certain of the plots received a treatment of ground limestone at the rate of 1 ton per acre and in 1913 a further treatment at the rate of 2 tons per acre. Certain other plots referred to in the text as unlimed plots have received no lime treatment. All plots receive, annually, applications of acid phosphate and muriate of potash, the former at the rate of 400 to 600 pounds per acre, and the latter at the rate of 100 to 200 pounds per acre. No nitrogenous fertilizers have been applied. For three or four years previous to planting the soybeans in 1913, the plots were in leguminous crops, but where it was necessary they were inoculated with soil from other soybean plots.

The results for 1913 to 1916, inclusive, have already been reported.[1]

Nineteen varieties were planted in the latter half of May, 1917. Three of these, however, were a failure on account of poor seed. Germination was good with the other varieties and the beans received the usual attention in the way of cultivation and hoeing. Part of the plots were 1-40 acre in size, and the others were 1-60 acre.

Results From the Crop Harvested as Hay

In order that a study might be made of the influence of the lime on the composition of the crop in the hay stage, and also on nodule formation, on July 18 twelve average plants, including roots, were removed from one of the rows of each of the six varieties that were growing on limed and corresponding unlimed plots, the nodules on each plant were counted, after which the plants were dried, weighed and prepared for analysis.

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[1] Lipman, J. G., and Blair, A. W., 1916. Factors influencing the protein content of soybeans, N. J. Agr. Exp. Sta., Bul. 282. Also in Soil Sci., v. 1, no. 2, p. 171.

Lipman, J. G., and Blair, A. W., 1917. The yield and nitrogen content of soybeans as influenced by lime. In Soil Sci., v. 4, no. 1.

The results of this study are set forth in table 2.

Table 2

The Influence of Lime on the Number of Nodules and percentage of Nitrogen when Soybeans are harvested as Hay.

(12 plants of each variety for each treatment)

VARIETY	DRY WEIGHT		NITROGEN		TOTAL NITROGEN		NUMBER OF NODULES PER PLANT	
	Limed Gm.	Unlimed Gm.	Limed Per cent	Unlimed Per cent	Limed Gm.	Unlimed Gm.	Limed	Unlimed
Baird,	96.0	52.5	3.24	3.23	3.110	1.696	117.9	41.0
Ebony,	79.0	37.0	3.59	3.28	2.836	1.214	86.8	21.5
Edna,	51.1	45.5	2.96	2.94	1.513	1.338	65.8	40.3
Guelph,	75.2	30.7	3.48	3.30	2.617	1.013	78.5	27.5
Ito San,	106.5	63.3	3.52	2.72	3.749	1.722	95.5	65.3
Wilson,	98.6	49.8	3.16	3.03	3.116	1.509	65.2	26.5
Average,	84.4	46.5	3.33	3.08	2.824	1.415	85.0	37.0

From this table it will be noted that the average yield of dry matter from the limed plots is 84.4 gm., as against an average of 46.5 gm. for the unlimed plots. Likewise, the percentage of nitrogen in the dry matter is one-fourth of one per cent higher for the limed than for the unlimed plots. Thus with a larger yield of hay, giving a higher percentage of nitrogen, the limed plots show an average recovery of just twice as much nitrogen as the unlimed plots.

A count of the nodules showed an average of 85 nodules per plant from limed plots and an average of 37 nodules per plant from the unlimed plots.

These results confirm the results secured in 1916 and point conclusively to lime as an important agent in the storing up of nitrogen by means of leguminous crops. It would appear that the lime brings the soil into a favorable condition for the development of nodule-causing organisms, and as these are increased in numbers, the number of nodules is greatly increased, with the result that the beans on the limed plots utilize much more atmospheric nitrogen than those on the unlimed plots. There is thus produced on the limed plots a larger, heavier plant giving beans and vines with a higher nitrogen (protein) content and therefore having a higher feeding value than beans and vines from the unlimed plots.

Table 3

The Influence of Lime on the Yield and Nitrogen Content of Soybeans Harvested at Maturity

(Calculated on the acre basis)

VARIETY	Soybean Seeds						Soybean Stalks						Total Nitrogen Recovered	
	Limed			Unlimed			Limed			Unlimed			Seeds & Stalks	
	Dry matter	Nitrogen	Nitrogen	Dry matter	Nitrogen	Nitrogen	Dry matter	Nitrogen	Nitrogen	Dry matter	Nitrogen	Nitrogen	Limed	Unlimed
	bus.	per ct.	lbs.	bus.	per ct.	lbs.	lbs.	per ct.	lbs.	lbs.	per ct.	lbs.	lbs.	lbs.
Austin,	20.90	6.005	72.06	......	......	......	1604	.618	9.91	......	......	......	81.97	......
Baird,	16.50	6.070	60.10	9.70	5.911	34.40	2580	.731	18.86	1398	.571	7.98	78.96	42.38
Cloud,	16 00	6.061	58.19	......	......	......	1860	.600	11.16	......	......	......	69.35	......
Ebony,	13.70	6.595	54.21	7.20	6.492	28.05	1608	1.058	17.01	1050	.806	8.46	71.22	36.51
Edna,	13.20	6.005	47.56	10.90	5.724	37.43	1758	.707	13.54	1410	.628	8.85	61.10	46.28
Elton,	14.63	6.773	59.47	......	......	......	1298	.824	10.70	......	......	......	70.17	......
Guelph,	17.10	5.986	61.42	7.00	5.90	25.49	2222	.871	19.44	948	.581	5.51	80.86	31.00
Haberlandt,	15.66	6.679	58.73	......	......	......	1720	.740	12.73	......	......	......	71.46	......
Ito San,	10.90	6.238	40.80	8.50	5.96	32.01	1530	.768	11.75	714	.646	4.61	52.55	36.62
Manchu,	16.50	6.370	63.06	......	......	......	1482	.778	11.57	......	......	......	74.63	......
Manhattan,	12.30	6.332	46.73	......	......	......	1446	.787	11.38	......	......	......	58.11	......
Medium Yellow,	16.50	5.873	58.14	......	......	......	1638	.703	11.52	......	......	......	69.66	......
Ohio 9035,	19.50	6.080	71.14	......	......	......	2100	.674	14.15	......	......	......	85.29	......
Swan,	12.00	6.745	48.56	......	......	......	1320	.778	10.27	......	......	......	58.83	......
Virginia,	17.06	6.145	62.92	......	......	......	1676	.600	10.06	......	......	......	72.98	......
Wilson,	15.20	5.733	52.28	10.35	5.714	35.48	1872	1.002	18.76	1257	.627	7.88	71.04	43.36
Average of six,	*14.43	*6.104	*52.73	8.94	5.95	32.14	*1930	*.856	*16.56	1130	.643	7.21	*69.29	39.36

* Average of the six varieties having corresponding unlimed plot. The other varieties did not have corresponding unlimed plots.

Results from the Matured Crop

Table 3 sets forth the results secured from sixteen varieties harvested at maturity and saved as shelled beans (bean hulls were included with stalks). Six of these varieties were grown on limed and six on corresponding unlimed plots, as heretofore described. The remaining ten varieties were grown on limed plots only. Of the six varieties grown on limed and unlimed plots, all gave a higher yield of both beans and straw on the limed than on the unlimed plots, the average increase for the beans being 5½ bushels and for the straw 800 pounds, per acre. Likewise the percentage of nitrogen in the dry matter (beans and straw) from the limed plots is higher than in the dry matters from the unlimed plots. The summary in table 4, with reference to the six varieties grown under the two conditions is of interest.

Table 4

Average Results with Six Varieties of Soybeans on Limed and Unlimed Plots

	Limed Plots	Unlimed Plots
Beans per acre (bu.)	14.43	8.9
Stalks per acre (lbs.)	1930.00	1130.00
Nitrogen in beans (per cent)	6.10	5.95
Nitrogen in stalks (per cent.)	0.86	0.64
Nitrogen in beans per acre (lbs.)	52.73	32.14
Nitrogen in stalks per acre (lbs.)	16.56	7.21
Nitrogen in beans and stalks per acre (lbs.)	69.29	39.35

It is thus apparent that, as in the case of the hay, much more nitrogen has been stored up by beans on the limed than on the unlimed plots, and one is forced to the conclusion that the lime plays a very important part in the process.

The highest yield was twenty bushels per acre from Austin. Baird, Cloud, Guelph, Haberlandt, Manchu, Medium Yellow, Ohio 9035, Virginia and Wilson gave yields between fifteen and twenty bushels. The remaining varieties—Ebony, Edna, Elton, Ito San, Manhattan and Swan—gave yields between ten and fifteen bushels.

Elton shows a nitrogen content of 6. 77 per cent, which is 1 per cent higher than Wilson, the lowest in per centage of nitrogen, but enough evidence has not been accumulated to justify one in saying that a given variety will always show a high percentage of nitrogen. The figures shown in table 5, however, are of interest in this connection. The table shows the percentage of nitrogen, with averages, in ten different varieties of soybeans for a period of 4 years. It is of interest to note that two varieties—Ebony and Swan—show a distinctly higher average than any of the others, while the average for Wilson is less than these two varieties by more than three-fourths of 1 per cent.

Ito San matured first and was harvested on September 22, followed by Elton and Manhattan on September 27; Manchu, Swan and Wilson (unlimed) October 2; Austin, Cloud, Medium Yellow, Ohio 9035, Virginia and Wilson (limed) on October 13 and Edna, Guelph and Haberlandt on October 24. Notes made on October 23 state that Guelph and Haberlandt at that time still retained some leaves, although there had been several heavy frosts.

Table 5

Percentage of Nitrogen in Different Varieties of Soybeans

VARIETY	Ebony	Swan	Ito San	Manhattan	Edna	Guelph	Medium Yellow	Ohio 9035	Cloud	Wilson
Year	%	%	%	%	%	%	%	%	%	%
1914, ...	7.13	6.82	6.83	6.98	6.69	6.91	7.06	6.69	6.67	6.26
1915, ...	6.74	6.66	6.55	5.92	6.35	6.50	6.26	5.90	5.89	5.92
1916, ...	6.60	6.46	6.03	6.24	6.39	5.70	5.84	5.88	5.74	5.73
1917, ...	6.60	6.75	6.24	6.33	6.01	5.99	5.87	6.08	6.06	5.73
Average, ...	6.77	6.67	6.41	6.37	6.36	6.27	6.26	6.14	6.09	5.91

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REPORT OF
DEPARTMENT OF BOTANY

Department of Botany

Byron D. Halsted, Sc.D., *Botanist.*

John W. Shive, Ph.D., *Plant Physiologist.*

Earle J. Owen, M.Sc., *Assistant Botanist.*

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Report of Department of Botany

BYRON D. HALSTED

I. INTRODUCTION

Since the results of this year's field experiments are not available they must be left for a later report; so little can be written at this time beyond a brief statement of the work in hand.

As heretofore, the various studies have continued under the two projects of Heredity and Environment and are concerned with twelve different types or species of plants, the foremost of which are beans, corn, eggplants, peanuts and peppers.

The greenhouse and laboratory work during the last winter has been concerned mainly with the selection, measurement and weighing of harvested seeds, together with an environmental study of corn, bean and peanut seedlings.

Some breeding work also was carried on with nasturtiums and tomatoes.

A survey of the field, comprising the four acres given over to botanical research work, shows that beans take up 15 plots. Seven plots[1] (1,400 plants) are occupied by tomatoes, 2 plots are given over to eggplants and a similar space to peppers, while there are 10 plots of corn and 5 of peanuts.

Series VII, with the exception of one plot, is occupied by the grains (barley, oats and wheat), these being grown for the study of environment.

II. HEREDITY

Reciprocal Crosses[2]

Peppers and tomatoes have been the principal subjects in this branch of the work, records of the former being given in the Annual Report for 1915.

Further breeding of peppers is being attempted. Concerning tomatoes, the Dandy Dwarf-Yellow Cherry set (158-183) grown so extensively last year, is being continued for further data, as are several other crosses comprising about one thousand plants.

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[1] The plots are 1/20 acre in size.

[2] The term "reciprocal" has the same application as in the previous Annual Report. For convenience the distinction is made between the terms "cross" and "hybrid," the former signifying a union of varietes and the latter a union of species.

Some results of last season's work are discussed by the botanist in the "Journal of Heredity" (vol. 9, No. 4, April, 1918), under the title "Reciprocal Breeding of Tomatoes."

The eggplant reciprocal represents the union of Dwarf Purple with the spineless form of Scarlet Chinese and is, therefore, a hybrid. With the Dwarf Purple as the female parent, the plants and leaves average larger, while in respect to diameter of flower the reverse is the case.

No apparent difference has been noted in size and shape of fruit.

In the second generation there is much variation among the plants of both combinations, the data of which are to be published later.

Inheritance of Hybrid Characters. The two hybrids now being studied are (1) the bean hybrid, a combination of the Scarlet Runner (*Ph. Multiflores*) and the Refugee Wax (*Ph. Vulgaris*); (2) the eggplant hybrid, a union of the edible Dwarf Purple (*Sol. Melongena*) and the non-edible Scarlet Chinese (*Sol. integrifolium*).

About two hundred plants of the former (1) are now growing in the third generation, showing the usual variations as noted in the previous reports (1916 and 1917) as to plant habit, color of flowers, pod type, yield, etc.

The narrow-leaved bush form is again in evidence, being correlated with slow growth, lack of vigor and barreness. It is therefore a strain difficult to establish.

The eggplant hybrid is represented by about fifty plants, now in the third generation. The Scarlet Chinese was spineless and all the offsprings, both in the first and in the second generation, inherited that character to the exclusion of the spiny habit of the Dwarf Purple parent. Thus far all third generation plants are likewise spineless, the character in this instance failing to Mendelize.

All plants of the third generation are smaller than those of the first, while they incline to be more strictly dwarf than the purple parent.

Few plants bear purple fruit, none of which approach the American type in size. Much data are on hand to be presented later.

Inheritance of Prolificness. Prolific and non-prolific plants have been selected from beans, eggplants, peanuts and peppers according to yield with a view of determining to what extent these traits are inherited. Results thus far have not produced sufficient evidence for any definite statement.

The fixation of New Types. This subject touches the dividing line between the reseach worker and the practical plant breeder.

The plant geneticist has for his object the establishing of a character or group of characters through successive generations regard-less of any economic importance. For instance, the tomato cross between Dandy Dwarf and Yellow Cherry noted above, gives in the second generation, as one type a yellow, coarse-leaved, dwarf plant with yellow fruits, which, since all characters are recessive, should breed true. But, in all probability, it would prove to be a weak, non-prolific strain and hence would possess no commercial value. Many desirable strains, however, result and some of these now growing are:

1. A wax-podded pole bean, resulting from the cross between Hodson Wax and Kentucky Wonder.
2. A green-podded pole bean from the same cross.
3. A crystal Wax type larger than the crystal parent.
4. A hybrid wax bean.
5. A "Giant Plum" tomato of commercial size.

III. ENVIRONMENT

Size of Seed as Related to Position in the Pod

The plants thus being studied are beans, peas, peanuts, soybeans and the grains (barley, oats, wheat). The grains represent work but recently undertaken, selections of seeds being made from the basal, central and tip portions of the head, spike or panicle as the case may be.

The number of plants per hill as related to ultimate yield is also being studied.

Depth of Planting as Related to Viability, Vigor and Yield

Beans, corn and soybeans are the subjects in hand for this experiment. The Burpee and Henderson Limas, with planting depths of 1, 2 and 3 inches, are being extensively grown, while position in the pod also is being considered.

The corn depth experiment of last year with various commercial types is being continued with first generation crosses from last season's breeding. Plantings were made of five different depths—1, 2, 3, 5 and 7 inches, the parents being included.

Below is given the planting scheme of one set only, each five rows representing the five depths in regular order.

1. Black Mexican, large grains	5 rows
2. Black Mexican, small grains	5 rows
3. Black Mexican upon New Tom Thumb, large grain	5 rows
4. Black Mexican upon New Tom Thumb, small grain	5 rows
5. New Tom Thumb, large grain	5 rows
6. New Tom Thumb, small grain	5 rows
7. New Tom Thumb upon Black Mexican, large grain	5 rows
8. New Tom Thumb upon Black Mexican, small grain	5 rows

Numbers 7 and 8 are "reciprocal" to numbers 3 and 4. With each row represented by 10 hills and 4 grains to the hill, 1,600 grains are required to complete the above set.

PUBLICATIONS OF THE DEPARTMENT FOR THE YEAR ENDING AUGUST 1, 1918

1—Halsted, B. D., and Owen, E. J., 1917.—Influence of position of grains on the cob on the growth of maize seedlings. *Jour. Amer. Soc. Agron.*, v. 9, No. 6, p. 267-274.
2—Halsted, B. D., 1918.—Color in vegetable fruits. *Jour. Heredity*, v. 9, No. 1, p. 18-23.
3—Halsted, B. D., 1918.—Reciprocal breeding in tomatoes. *Jour. Heredity*, v. 9, No. 4, p. 169-173.
4—Halsted, B. D., and Owen, E. J., 1917.—Environment of seeds and crop production. *Plant World*, v. 20, No. 9, p. 294-297.
5—Halsted, B. D., 1917.—Abortiveness as related to position in the legumes. *Proc. 38th Ann. Meeting Soc. Prom. Agr. Sci.*, p. 69-73.

REPORT OF PROGRESS IN PLANT PHYSIOLOGY

The work in Plant Physiology has been somewhat curtailed during the year because of the fact that no competent assistance in carrying on the experimental routine has been available. For want of applicants the position of research assistant remained vacant during the year, and no graduate research students have been registered for work in Plant Physiology.

The work has been conducted along two principal lines: (1) a study of the salt requirements of plants at different stages of their development, and (2) a study of the relation of the moisture content of the substrata in which the plants are rooted, to the proportions of the fertilizer constituents as these affect the growth rates of plants in pot cultures, various types of soil and sand being employed.

The work which was carried out during a part of last year, with reference to the fertilizer salt requirements for optimum growth of plants at different stages of their development, was duplicated during the present year and the results of these studies have been prepared for publication and are now in press. This work is now being continued with different species of plants under varying experimental conditions.

The results of the second line of research which was taken up during the year, are not yet available, but the work thus far has shown that the physiological balance of salt proportions in the different media is not materially disturbed by rather extreme variations in moisture content. On the other hand, variations in the moisture content of the media have a greater influence upon the growth rates of the plants than have rather extreme variations in the proportions of the fertilizer constituents. This emphasizes the importance of controlling the moisture content of the media in which plants are grown, in all studies relating to the effects of fertilizer combinations upon the growth of plants. These studies are now being continued and they have been extended to include experiments aiming to determine the relation of moisture content to the effects of toxic materials, upon the growth of plants, when added to the media in which the plants are rooted.

A list of technical papers published from the Laboratory of Plant Physiology during the year is appended.

Shive, J. W., 1917.—Toxicity of monobasic phosphates towards soybeans grown in soil and solution cultures. *Soil Science*, v. 5, No. 2, p. 87-122.
Shive, J. W., 1917.—A study of physiological balance for buckwheat grown in three-salt solutions. *N. J. Agr. Exp. Sta. Bul. 319.*
Shive, J. W., and Martin, W. H., 1918.—A comparison of salt requirements for young and for mature buckwheat plant in water cultures and sand cultures. *Amer. Jour. Bot.*, v. 5, No. 4, p. 186-191.
Wolkoff, M. I., 1918.—Effect of ammonium sulfate in nutrient solutions on the growth of soybeans in sand cultures. *Soil Science*, v. 5, No. 2, p. 123-150.

REPORT OF THE DEPARTMENT OF ENTOMOLOGY

Department of Entomology

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ALVAH PETERSON, PH.D., *Assistant Entomologist.*
AUGUSTA E. MESKE, *Stenographer and Clerk*

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* On State Station.
† Appointed February 1, 1918.

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Report of the Department of Entomology

Thomas J. Headlee

INTRODUCTION

The period covered by the present report extends from November 1, 1917 to June 30, 1918. Because of this shortening of the fiscal year, which was due to an act of the Legislature of 1918, the work reported is necessarily limited to that which could be accomplished during the non-active season of 1917 and the forepart of the active season of 1918. The lines followed and the results accomplished are set forth in the body of the report.

The personnel of the staff has experienced little change. Miss Augusta Meske has continued as clerk in charge of the office and has been assisted regularly by Miss Grace B. Wobbe and temporarily from time to time by various stenographers. Dr. Alvah Peterson has worked along lines of insects injurious to agriculture, giving especial attention to orchard aphis and to the peach borer. With the opening of the present season he began an investigation of the methods for control of the Oriental Peach Moth (*Laspeyresia Molesta*). Mr. Charles S. Beckwith continued his work in connection with mosquito control. On November 6, 1917, while riding his motorcycle, he was struck by an automobile and sustained a compound fracture of the right leg, which prevented him from doing any active work for a period of about five months. With the opening of the season his attention was devoted to the habits, life history and control of the sprinkling sewage filter fly (*Psychoda alternata*). When this work was completed his attention was turned to cranberry investigations. On the first of February, Mr. Mitchell Carroll, of the University of Pennsylvania, was employed as assistant to the entomologist of the State Experiment Station, and has given his attention since joining the staff to the problems of mosquito control.

INSECT CORRESPONDENCE

The insect correspondence is a little larger than during a similar period of last year. Approximately 4,000 letters have been sent out. Inquiries concerning 82 species of insects have been received and answered. The tabular list which follows will serve to give an idea of the species concerned.

VERMES

Latin Name	Common Name	Locality	Date
Tubifex tubifex Muller	Red worm	Trenton	Feb. 14

ARACHNIDA

Bryobia pratensis Garman	Clover mite	Middletown	Apr. 1
Eriophyes pyri Pgst.	Pear leaf blister mite	Moscow, Idaho	Dec. 13, '17
" " "	" " " "	Vineland	May 18
Tetranychus sp.	Red spider	German Valley	Mar. 27

INSECTA

Thysanura

Collembola sp.	Spring tail	Bridgeton	May 18

Isoptera

Termes flavipes Koll.	White ant	New York City	May 18

Parasitica

Hæmatopinus asini Linn.	Sucking louse of the horse and ass	Camp Devens, Mass.	Feb. 4

Homoptera

Aphididæ	Potato plant lice	Ridgewood	Feb. 21
"	Plant lice	Hopewell	Mar. 15
"	" "	Springfield	June 6
"	" "	Richland	June 19
"	" "	Paterson	June 25
"	" "	Toms River	June 26
"	" "	Newton	June 26
Aphis houghtonensis Troop	Gooseberry aphis	Moorestown	Apr. 6
Aphis mali Fabr.	Green apple louse	Trenton	Jan. 16
" " "	" " "	Titusville	Feb. 11
" " "	" " "	Newton	Feb. 21
" " "	" " "	Watchung	Feb. 28
" " "	" " "	Vineland	Mar. 25
" " "	" " "	Holmdel	Apr. 24
Aspidiotus hederæ Vall.	Oleander Scale	New Brunswick	Apr. 26
" perniciosus Comst.	San Jose Scale	West Orange	Apr. 6
" " "	" " "	Woodbury	Apr. 24
Chermaphis pinicorticis Fitch	Pine bark aphid	Riverton	Mar. 9
Chionaspis euonymi Comst.	Euonymus scale	Rumson	Nov. 3
Coccidæ	Armored scale	Vineland	Nov. 13
Euleucanium nigrofasciatum Perg.	Terrapin scale	Merchantville	Mar. 15
Lepidosaphes ulmi Linn.	Oyster shell scale	Allentown	Oct. 29
" " "	" " "	Hackettstown	Mar. 4
" " "	" " "	Morristown	Mar. 9
" " "	" " "	Cranford	Apr. 4
" " "	" " "	Union	Apr. 4
" " "	" " "	Hackettstown	Apr. 26
" " "	" " "	Philadelphia	June 20
Myzus ribis Linn.	Currant aphis	Haddon Heights	May 25
Pemphigus bursarius Linn.	Plant louse gall	New York City	May 31
" " "	" " "	" " "	June 15
Phylloxera caryæ-caulis Fitch	Hickory gall	Bridgeton	June 6
" " " "	" "	Bernardsville	June 17
Psylla pyricola Forst.	Pear psylla	Vineland	Mar. 25
Schizoneura lanigera Hausm.	Woolly apple louse	Verona	Mar. 13

Hemiptera

Cimex lectularius Linn.	Bed Bug	Mt. Lakes	Mar. 25
Tibicen septendecim Linn.	17-year locust	Brielle	June 20

Orthoptera

Latin Name	Common Name	Locality	Date
Acrididæ sp.	Grass hoppers	Plainfield	Mar. 25
Microcentrum rhombifolium Saus.	Katydid	Minotola	Mar. 25
" " "	"	Moorestown	Mar. 26
Œcanthus fasciatus Fitch	Striped tree cricket	Riverton	Mar. 28
Scudderia texensis S. & P.	Cranberry Katydid	Asbury Park	Mar. 13
" " " " "	" "	Waterford Works	Apr. 26

Coleoptera

Latin Name	Common Name	Locality	Date
Amphicerus bicaudatus Say.	Twig borer	Berlin	Apr. 24
" " "	" "	Millville	May 6
Anthonomus signatus Say.	Strawberry weevil		Feb. 21
" " "	" "	Moorestown	Apr. 11
" " "	" "	Berlin	Apr. 24
" " "	" "	Magnolia	May 20
Attagenus piceus Oliv.	Black carpet beetle	Irvington	Apr. 4
Bruchus obtectus Say.	Bean weevil	Barnegat	Feb. 11
" " "	" "	West Orange	May 1
" " "	" "	Summit	June 4
Cassida bivittata Say.	Gold Bug	Minotola	June 26
Chrysobothris femorata Fab.	Flat-headed apple-tree borer	Trenton	May 25
Conotrachelus nenuphar Herbst.	Plum curculio	Hackettstown	May 28
" " "	" "	Glassboro	May 31
" " "	" "	Chester	June 6
" " "	" "	Somerville	June 28
Cryptorhynchus lapathi Linn.	Willow borer	Newark	Dec. 28, '17
Desmocerus palliatus Fabr.	Borer	Murray Hill	May 31
Diorymellus lævinargo Champ		Lakewood	June 26
Drasterius elegans Fabr.	Wire worms	Puyallup, Wash.	Mar. 26
" " "	" "	Jamesburg	May 20
Elateridæ	" "	Red Bank	May 22
"	" "	New Egypt	May 22
Epitrix cucumeris Harr.	Potato flea beetle	Mt. View	Feb. 25
" " "	" " "	Burlington	Apr. 24
" " "	" "	Plainfield	May 24
" " "	" " "	New York City	June 6
" " "	" " "	Verona	June 11
" " "	" " "	Barnegat	June 14
" sp.	Flea beetle	Plainfield	May 29
Euphoria inda Linn.	Bumble flower beetle	Englewood	June 4
Macrodactylus subspinosus Fab.	Rose bug	Rutherford	June 4
" " "	" "	New York City	June 17
Papalpema nitela Gn.	Common stalk borer	Chatham	June 4

Lepidoptera

Latin Name	Common Name	Locality	Date
Alsophila pometaria Peck	Fall canker worm	Hoboken	Mar. 13
" " "	" " "	Woodbury	Mar. 13
Archips fervidana Clem.	Leaf roller	Trenton	June 26
Carpocapsa pomonella Linn.	Codling moth	Woodbridge	Nov. 5, '17
" " "	" "	Old Bridge	May 8
Euproctis chrysorrhæa Linn.	Brown tail moth	Ringoes	Jan. 14
Halisidota caryæ Harr.	Hickory tussock moth	New York City	May 28
Heliothis armiger Hbn.	Corn ear worm	Leonia	Nov. 6, '17
" " "	" " "	Vineland	Apr. 9
Hemerocampa leucostigma S. & A.	White-marked tussock moth	Elizabeth	Mar. 5
" " " " "	" " " "	German Valley	Mar. 26
" " " " "	" " " "	Montreal, Can.	Apr. 4
" " " " "	" " " "	Union Hill	Apr. 4
" " " " "	" " " "	Hollis, N. Y.	Apr. 4
" " " " "	" " " "	Paterson	Apr. 4
" " " " "	" " " "	Hammonton	Apr. 4
" " " " "	" " " "	Bayonne	Apr. 6
" " " " "	" " " "	East Orange	Apr. 8
Hyphantria cunea Dru.	Fall webworm	New Brunswick	May 27
Laspeyresia molesta Busck	Oriental peach moth	Middletown	Mar. 20

LEPIDOPTERA—Continued

Latin Name	Common Name	Locality	Date
Lepidoptera	Caterpillar	Summit	Jan. 21
Macronoctua onusta, Clem.	Iris borer	Princeton	May 25
Marmara salictella Clem.	Leaf miner	Verona	Mar. 13
Melittia satyriniformis Hbn.	Squash borer	So. Orange	May 22
" " "	" "	Newark	May 31
" " "	" "	Chatham	June 4
" " "	" "	Passaic	June 6
Noctuidæ sp.	Cut worms	Newton	May 22
Oxyptilus periscelidactylus Fitch	Grape plume	Clifton	May 16
" " "	Grape plume moth	Lyndhurst	May 21
" " "	" " "	Cranford	May 22
" " "	" " "	Paterson	May 28
" " "	" " "	Paterson	June 10
Phlyctænia rubigalis Guen	Green house leaf tier	Summit	Feb. 4
Polychrosis viteana Clem	Grapeberry moth	Somerville	Mar. 8
Sanninoidea exitiosa Say.	Peach borer	Cranford	Jan. 28
" " "	" "	Moorestown	Feb. 27
" " "	" "	So. Orange	Apr. 18
" " "	" "	Ocean Port	May 16
Thyridopteryx ephemeræformis Steph	Bag worm	Maple Shade	Mar. 15
" " "	" "	Teaneck	Mar. 19
" " "	" "	Sewell	Mar. 25
" " "	" "	Union	Apr. 24
" " "	" "	Swedesboro	June 25
Vanessa antiopa Linn.	Mourning cloak butterfly	Moorestown	May 31

Hymenoptera

Latin Name	Common Name	Locality	Date
Apis mellifera Linn.	Honey Bee	Andover	Jan. 8
" " "	" "	Vineland	Jan. 19
Camponotus herculeanus pennsylvanicus, DeG.	Carpenter Ant	Oxford	Mar. 30
Diastrophus niger Bass	Gall fly	Freehold	June 26
Evania appendigaster Linn.	Parasite on eggs of cockroach	Camden	May 8
Formicidæ sp.	Ants	Newark	May 16
" "	"	Woodbury	June 14
" "	"	Toms River	June 26
Pteronus ribesi Scop.	Currant-worm	River Edge	Mar. 27
" " "	" "	Arlington	Apr. 24

Diptera

Latin Name	Common Name	Locality	Date
Anopheles crucians Wied.	Malaria mosquito	Cape May	Mar. 28
" " "	" "	" "	Mar. 28
Anopheles sp.	" "	Bound Brook	Apr. 4
Cecidomyia occellaris O. S.	Maple leaf spot	New York City	June 4
Culicidæ sp.	Mosquitoes	Harrisburg, Pa.	Mar. 25
" "	"	Wash., D. C.	Mar. 29
" "	"	Philadelphia, Pa.	Mar. 30
" "	"	Tupelo, Miss.	Mar. 30
" "	"	Sibley, Miss.	Apr. 1
Lasioptera vitis O. S.	Potato gall	Pt. Pleasant	May 31
" " " "	" "	River Edge	June 19
Pegomyia vicina Lintn.	Spinach or beet leaf miner	New York City	May 25
" " "	" " " " "	Newark	June 20
Phorbia brassicæ Bouche	Cabbage maggot	Montclair	May 20
" " "	" "	Summit	June 26
" ceptorum Meade	Onion maggot	Allenwood	Feb. 21
Psychoda alternata Say.	Sprinkling sewage filter fly	Trenton	Feb. 14

MAMMALS

Latin Name	Common Name	Locality	Date
Mus norvegicus	Brown rat	Toms River	Dec. 20, '17

INSECTS OF THE YEAR

Plant Lice

This year, as last, orchard and vegetable plant lice have been very abundant. Without doubt this is correlated with the cool weather which prevents the parasitic enemies of these insects from destroying them. While our knowledge of substances to be used for the destruction of these lice is fairly complete and satisfactory, our information on the type of machinery that should be used in controlling the vegetable species is exceedingly limited. Furthermore, the spraying practice of apple orchardists and of vegetable growers, with a few exceptions, does not even approximate our knowledge of what should be done. We are faced with the problem of putting the necessary information on control of these species before our people in such a way that they can take it up and do the work efficiently.

Flea Beetles

This year, as for a number of years past, the cucumber and tomato flea beetles, *Epitrix cucumeris* Harr. and *Epitrix fuscula* Cr., have been extraordinarily abundant and have done a large amount of damage to potatoes and tomatoes. Unfortunately our knowledge of methods of controlling these insects is in an unsatisfactory state. We have nothing at present which will prevent approximately 100 per cent of the damage. Careful and thorough applications of Bordeaux in such a way as to cover all parts of the infested plants will eliminate a large percentage of the injury. With ordinary spraying practice about 50 per cent of the damage can be prevented, but, by more thorough treatments a larger percentage of the damage can be prevented. Applications of arsenate of lead and sulfur dust made up at the rate of 1 to 5 form an efficient protection against these beetles, provided the coating is maintained. Further work of an investigational nature is without doubt needed on these species.

Oriental Peach Moth

Through work financed by the United States Department of Agriculture and carried out in cooperation with the state entomologist of the New Jersey State Department of Agriculture, the area of distribution of the Oriental Peach Moth (*Laspeyresia molesta*) is now known to include Middletown and New Brunswick as well as Rutherford and Springfield. In the first-named section damage by this insect may prove to be very large. In view of the serious outlook for damage and the lack of information on successful measures of control, Dr. Peterson has begun an investigation of this insect.

Horse-radish Flea-beetle

For several years the horse-radish flea-beetle (*Phyllotreta armoraciae* Fab.) has been giving a great deal of trouble to growers of this vegetable in the Brookdale section. It seems to emerge from winter quarters in the spring, just as the horse-radish sprouts are coming through the ground, and to consume them at such a rate as to greatly delay and partly destroy the crop. This year some tests were made of substances to destroy it and of substances to prevent its work. Pieces of horse-radish root sliced and treated with Paris green suspended in water were scattered about the field and large numbers of the beetles were killed. The growing tips were coated with sulfur, with arsenate of lead and sulfur 1 to 5, and with hydrated lime. The arsenate of lead and sulfur seemed to give the best protection, although the plants treated with lime were not seriously troubled. Blowing machinery was prepared to carry on more extended experiments against this insect, but the plants started off quickly and outgrew the injury to such an extent that there was no opportunity for carrying out further experiments.

Seed Corn Maggot

This year experiments for the control of the seed corn maggot (*Pegomyia fusiceps*) similar to those outlined in the 1917 report were carried out. The data are not at hand at this time and cannot therefore be included.

INVESTIGATIONS

Pear Psylla

In the report for 1916 the entomologist recommended the following procedure against the pear psylla.

1. Scraping the rough bark from the trees in late fall or early winter.
2. Thorough spraying of the trees during a warm spell, after the scraping had been completed, when the psylla could be found walking stiffly over the tree trunks and branches; with either winter-strength soluble oil or 40 per cent nicotine [1 to 500 plus soap 2 pounds (soft water) or 4 or 5 pounds (hard water) to 50 gallons] just before the buds burst.
3. Thorough spraying with winter-strength lime-sulfur just as the flower buds begin to open.

It was explained that No. 1 was intended to deprive the psylla of winter cover, No. 2 to kill the adults, and No. 3 to destroy the eggs laid by the over-wintering brood.

The work of 1917 served to show that some of the over-wintering psylla had not completed egg-laying by the time No. 3 had to be applied, for eggs were found after the blossoms had opened and indeed after they had fallen.

In the report for 1917 the results of work against the psylla in three different orchards were set forth as follows; "The facts gathered during this season's experience seem to show conclusively that while the number of psylla destroyed by treatments at present recommended may sufficiently reduce the insect to prevent serious staining of the fruit, damage will in all probability be done to the foliage, and with a favorable season to the fruit itself."

Collins Orchard. For some years this orchard has been suffering from psylla. Last year a determined effort was made to conquer it. A small part was scraped, practically all was winter-sprayed, and all was given the treatment with winter-strength lime-sulfur just before the flower buds burst. The net result was such a reduction of psylla as to permit the production of a crop of fruit practically free from staining. This year the scraping was extended, the winter spraying omitted and the spring application made. The net result thus far has been a heavy infestation of psylla in the third week in June. The control this year is not nearly so good as that effected last year. This bears out the importance of the omitted winter treatment. In the 1917 report the following statement bearing on this point occurs: "The difference between the trees of the unscraped blocks that were treated with both scalecide and commercial lime-sulfur and those that were treated with commercial lime-sulfur alone was much greater than the difference between the twice-sprayed unscraped and the twice-sprayed scraped trees. This indicated, as might be expected, that the dormant spraying with scalecide was much more important than the scraping." These facts indicate rather clearly that with the methods of spraying now in use in this orchard reasonably satisfactory control can not be had without the winter spray.

During the last week in June for the purpose of seeing what could be done with summer treatments two blocks of three rows were sprayed; one with 40 per cent nicotine (1 to 500) and soap (2 pounds to 50 gallons) and another with lime-sulfur (summer strength) and 40 per cent nicotine (1 to 500). In neither case was a sufficiently high percentage destroyed, but better results came from the latter than from the former. It was felt that the thoroughness of the treatment was not sufficient to justify dismissal of the measure as a useless expenditure of time and money. The application of a lime and of a lime and sulfur dust was made but seemed absolutely ineffective, the particles riding upon the globules of honey-dew without in any apparent way interfering with the health or prosperity of the psylla nymphs underneath.

Taylor Orchard. The psylla has been on the increase in this orchard for a period of several years, and no effective efforts have been made to control it. The trees were neither scraped nor winter-sprayed but were rather thoroughly coated just before blossoming with winter-strength lime-sulfur. When examined the second week in June, few psylla could be found.

Lippincott Orchard. Three years ago last winter the J. L. Lippincott Co. applied for help against psylla. A portion of the orchard was scraped, a part winter-sprayed and all treated with winter-strength lime-sulfur just before the blossoms opened. Examinations later in the season showed that decidedly the best results came from that portion of the orchard which was both scraped and winter-sprayed, and that the unscraped trees which received the winter spraying were cleaner than those which did not. During each of the following seasons the scraped block was extended and both winter and spring treatments were applied. Each year the control of the psylla has grown better until this year during the fore-part of the season it seemed practically perfect. When examinations were made during the second week in June no specimens of psylla could be found.

From these results we may draw in the following conclusions:

1. All three treatments are important and where psylla is bad none should be neglected.
2. The least important is the scraping.
3. Faithful annual practice of the winter and spring spraying accompanied by as much scraping as may be necessary to keep the trees clean will bring the psylla under reasonably satisfactory control
4. Thoroughness of coating coupled with the proper time of application is absolutely essential to success.

Plum Curculio

There have been so many failures to control this insect by our better apple growers during the last few years that the entomologist gave the matter close attention during the present season. Last year's study showed clearly that failure to control resulted from the fact that the insect made its attack after the blossom-fall spray coating had been largely eliminated by the weather and especially by the rapid growth of the fruit and before the ten-days-after-blossom-fall spray had been applied. To close up this gap the spray schedule was this year amended by the following note: "When curculio injury is likely to be severe it is recommended that No. 4 be applied 7 days after the petals fall and repeated 10 days later." The nature of this variation is set forth in the following table.

1917 Schedule	1918 Schedule
1. Before the buds swell. If aphis eggs are present on the trees delay this treatment until buds show green, but complete same without fail before the little leaves stick out like tiny squirrel's ears.	1. Same as 1917.
2. As blossoms first show color.	2. Same as 1917.
3. Directly after the petals fall.	3. Same as 1917.
4. Ten days after blossoms fall.	4. 7 days after blossoms fall.
5. June 20th to 30th for all fall and winter varieties.	5. 17 days after blossoms fall.
	6. June 20th to 30th for all fall and winter varieties.

As a matter of fact, the plum curculio is in the orchard and able to do damage usually from the time the petals fall until a period of one month has passed by. This would mean that the spray coating of fruit and foliage, particularly of the former, should be maintained throughout this period. Experience of the past several years clearly indicates that ordinarily under our conditions the damage is done in a few days sometimes within ten days after the blossoms fall. This may be due to the fact that the coating after the ten-days-after-blossoms-fall spraying is maintained much better than before that treatment. The entomologist is not clear on this point but feels from relatively incomplete observations, which he has been able to make that this condition is due more to the habit of the insect than to the more complete coating.

This year those who have applied the extra spray with sufficient thoroughness have eliminated the normal curculio damage. There have been two especially good examples of this result.

Mr. Harry Holcombe, who is running the Brisbane orchards at Allaire, has completely conquered the curculio, although until this year these orchards have been neglected and this insect allowed to work at will. The crop on unsprayed apple trees on this farm this year has been ruined by the curculio. Mr. Barclay Moon, whose apple orchard is located near Clementon, has succeeded this year for the first time in eliminating serious curculio damage. Last year the curculio took his crop. Both men have closed up the gap between the blossom-fall and the ten-days-after-blossom-fall spray by the introduction of another spray as outlined in the above schedule.

Thoroughness of application, by means of which the fruit and foliage are kept well coated, is an absolutely necessary point. Without this thoroughness, control of the insect can not be had. The material operates largely as a repellant and the curculio will search out the uncovered spots on the apple fruit surface.

Better results are secured with a mixture of lime-sulfur and arsenate of lead than with arsenate of lead alone. The lime-sulfur seems to have a repellant action.

Sprinkling Sewage Filter Fly

(*Psychoda alternata*) Say.

Thomas J. Headlee
and
Charles S. Beckwith

Introduction

This small light-colored mothlike fly has proven itself a serious nuisance wherever sprinkling filters have been utilized for the purification of fæcal sewage. When the sprinkling filters are located at great distances from human habitation the matter seems to have proven a nuisance only; but when located within reach of human habitation, a mile or less, these flies penetrate the houses, get into the foods and are accused by the persons concerned of being the carriers of infections from which they suffer. There seems to be no clearcut evidence to show that they are responsible for the carriage of infections, but in the opinion of the part of the public concerned they are firmly identified as carriers, and suits at law have been and are always likely to be filed against the municipality or company running such a filter plant.

The Joint Sewer Committee of the city of Plainfield and the boroughs of North Plainfield and Dunnellen, feeling that everything possible should be done to render the sewage disposal plant under its charge a pleasant neighbor for the people living in the vicinity, called the senior author into consultation for the purpose of finding out a way to eliminate this nuisance. A survey of the literature showed that the only method holding out any hope of controlling the pest was one embodied by Metcalf and Eddie in their advice to use charges of hypochlorite of lime.

After considerable reflection, the senior author decided that a study of the insect and its habits would have to be made and a test of the various insecticides instituted.

Habits and Life History

The work began when the sprinkling filter still had a capping of ice. It was found that each piece of stone had upon it a more or less complete amorphous coating, which on examination proved to be exceedingly complex, being composed of a ground work or matrix of gelatinous material in which and on which were found immense numbers of bacteria, algæ, protozoa (single-celled animals), worms (unsegmented and segmented) and arthropods (principally crustacea and insects). The sprinkling sewage filter fly was found in the maggot and pupa stages resting just in this film with the breathing tube or tubes projecting through the film and securing atmospheric air.

As soon as possible the junior author undertook the task of determining the life history and habits. This study continued through the spring into the summer. It was found that the principal species concerned was *Psychoda alternata* Say, but that during the latter part of April *Psychoda cinerea* Banks appeared. It was found that with the opening of warm weather the flies emerged from the over-wintering pupæ and larvæ in such numbers that for a period it was almost impossible to breathe while working at the filter without getting some of them in the nose or mouth. After the over-wintering film had broken down and sloughed off and the warm weather film and begun to form the flies rapidly disappeared until they became so scarce as no longer to form a nuisance. Records of the preceding summer (1917) show that with the advancement of the season the summer film becomes steadily heavier and the flies more abundant until in the month of August when they reach a density greater even than that of the forepart of the warm season.

It seems that the abundance of flies is correlated with the thickness of the film. A thick heavy film is normally accompanied by a tremendous breeding of the sprinkling sewage filter fly.

A study of the food habits of the maggots showed that the feeding takes place in the film and that the food apparently consists of portions of the film. This habit of feeding, of course, serves to explain the increase in fly breeding which accompanies an increase in the thickness of the film.

The eggs are laid upon the surface of the stone in irregular masses of from 30 to 100. The egg is about 0.36 mm. long and 0.17 mm. wide, oval in shape, white in color and resembles under a microscope nothing so much as a very small rice grain. With the exception of the yolk, the egg is almost transparent. From 32 to 48 hours were required for hatching at a temperature of 70°F.

The larvæ or maggots are very much like mosquito wrigglers and seem to pass their existence in much the same way. Soon after hatching they make their way into the film where they thrust their breathing tubes through the film itself. The number of larvæ on a sprinkling sewage filter bed is almost unbelievably large. A single square inch of stone has been found to accommodate as many as sixty specimens. The larvæ are present throughout the filter from top to bottom, but they are most abundant in the zone which begins three inches below the surface and ends twelve inches below the surface. The length of the larval stage ranges from

9 to 15 days under a temperature of 70°F. The largest active larvæ taken at any time in this study was 9.2 mm. long.

Transformation to the pupa takes place in the location where the larvæ fed and developed. The two breathing tubes with which the pupæ are furnished are thrust through the film where atmospheric air may be obtained. The pupa, of course, does no feeding and is able to move only by jerking its abdomen. The pupa is about 6 mm. long, exclusive of the breathing tubes, and requires from 20 to 48 hours to complete development at 70° F.

For the sake of completeness the writers include the notes on the adult as given by Dr. Haseman (Transactions of the American Entomological Society, vol. 33, p. 320) "These vary considerably among themselves, and differ in many respects from Banks' description of *Ps. alternata,* especially in size and darker shade. The thorax and anterior portion of abdomen varies from light yellowish to brownish black; the posterior portion of the abdomen being lighter. In some specimens the patches at the tips of the veins are brown, and the wings conspicuously marked with black. The patches at the tip of veins 4 and 6 are usually bordered within with a patch of white, and sometimes white patches are present next to other of the apical blotches of black; posterior fringe almost one-half breadth of wing. The antennæ are 14-jointed as long as breadth of wing; the first segment longer than broad, second globular 3-12 with basal enlargements and slender pedicles; pedicle of 12 short, but not reduced so much as shown in figure; 13 spherical, closely joined to 14, which has a terminal spike. Ventral plate almost as broad as long,, cleft over half-way to base. Ovipostor quite strong, slightly curved. tapering gradually to rather acute tip, one-fifth millimeter long. Inferior male genitalia very long, slender, sickle shaped, with strong clavate tenticle at tip; basis of inferior appendages with short median terminal spike; rounded laterally and only slightly tapering toward base; superior male appendages 2-jointed; basal segment strong shorter than terminal one, which is slender, with acute tip, bearing short spinules. Intromittent organ longer than terminal segment of superior appendages, slender, slightly curved downward. Length of wing 1.6-1.75 mm.; breadth 0.6-0.7 mm."

Control

The habits of the adult fly are such as to preclude the control of the species through the destruction of the mature form. Nothing short of covering the filter with screening which has been treated with a substance similar to tanglefoot could be depended upon to destroy the adult. The shutting off of the air supply, which would result from covering the filters in this way was thought by the engineer in charge to be undesirable from the standpoint of the effective operation of the filter. Furthermore, the cost of such an installation would be large and the length of time the netting would remain effective would be limited.

The problem of control seemed therefore to narrow down to a question of destroying the fly in its immature stages. In view of the fact that the immature stages of the fly, with the exception of the egg, are passed in the film, which is the active agent in the purification of the sewage, it seemed necessary to secure an agent, which would be selective in its action in destroying the immature stages of the fly and not seriously injuring the other components of the film. A considerable number of chemicals were tried in all cases with a view of determining the minimum dosage for the fly and its effect on the life and activity of the other elements of the film. Tables 1 and 2 show the results.

Table 1

Results of Treatment of Filter Bed with Insecticides

Thickness of Coating	Borax	Hypochlorite of Lime	Stone Lime	Copper Sulfate	Iron Sulfate	Pyrethrum
1/2 in.	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Film dead Larvæ dead	Larvæ dead Film dead	Larvæ dead Film dead
1/4 in.	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead
1/8 in.	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ dead Film dead
1/16 in.	Larvæ alive Film alive	Larvæ dead Film dead	Larvæ dead	Larvæ dead	Larvæ dead	Larvæ alive Film alive
1/32 in.		Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	
1/64 in.		Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	Larvæ dead Film dead	
1/128 in.		Larvæ dead Film dead	Larvæ alive Film alive	Larvæ dead Film dead	Larvæ alive Film alive	
1/256 in.		Larvæ dead Film dead		Larvæ alive Film alive		
1/512 in.		Larvæ dead Film dead		Larvæ alive Film alive		
1/1024 in.		Larvæ dead Film alive		Larvæ alive Film alive		

Table 2

Results of Treatment of Filter Bed with Insecticides Flooding

Rate of Treatment	Carbon Bisulfide	Black Leaf 40 Diluted 1-50	Black Leaf 40 Diluted 1-500	Saturated Solution of Hellebore
1 oz. to 1 sq. ft.	Larvæ dead Film dead	Larvæ dead Film alive	Larvæ alive Film alive	Larvæ dead
½ oz. to 1 sq. ft.	Larvæ dead Film dead	Larvæ dead Film alive	Larvæ alive Film alive	Large Larvæ dead Small Larvæ alive Film active
¼ oz. to 1 sq. ft.	Larvæ dead Film injured but still alive	Larvæ dead Film alive	Larvæ alive Film alive	

In general the tables show that the minimum dosage for the fly is destructive to the film. Three materials—hypochlorite of lime, carbon bisulfide, and 40 per cent nicotine—gave some promise in the preliminary tests outlined above.

Forty per cent nicotine, diluted with 50 parts of water, was applied to the filter bed at the rate of ¼ ounce to the square foot, but it did not kill the larvæ. The filter in question involved nearly 80,000 square feet of surface, representing a need of 20,000 ounces of 40 per cent nicotine, or 1,250 pounds, which at present prices would cost more than three thousand dollars for material for a single treatment. This was, of course, sufficient to show that further experiments with a 40 per cent nicotine were not worth while.

Carbon bisulfide was applied to the filter at the rate of ¼ ounce to the square foot, and killed the film wherever it actually touched it, but had no effect on the fly 3 inches below the surface. At this rate 1,666 pounds of carbon bisulfide would be necessary for a single treatment involving an outlay at the ante bellum prices of over eighty dollars, and at present prices very much more.

The hypochlorite of lime applied in the same way, at the rate of as much as 100 pounds to the acre did not materially affect either the maggots or the film.

The difference in the results obtained by treating the small containers and treating the filter bed is probably due to the fact that the stone in the small containers was necessarily disturbed in being removed from the bed and placed in the containers, and the film more or less injured in the process.

The tests above outlined having turned out in such an unsatisfactory fashion, it was decided to reexamine the work done by Messrs. Metcalf and Eddie in the use of hypochlorite of lime. On page 760 (vol. 3) of "American Sewage Practice" we find the following statement by these authors.

"It may also be valuable in preventing the diffusion of objectionable odors from the spraying of sewage when dosing trickling filters, as demonstrated by John D. Watson at Birmingham, England, (Report of the Metropolitan Sewerage Commission of New York, 1914, page 188) in reducing organic growths tending to clog such filters and in killing the little moth flies which thrive in and about the filters. Its effectiveness for this purpose has been demonstrated by Harry J. Hanmer, City Engineer, Gloversville, N. Y., who has used it with some success, on the advice of the authors. Twelve pounds of dry powder was added to each of three 16,720-gallon doses (equivalent to 28.7 parts per 1,000,000) on one day, and the same treatment was repeated on the second day thereafter. The rate of application was approximately 12 pounds per acre per day, equivalent to about 12 pounds per 1,000,000 gallon per day. This treatment killed the larvæ and young flies but did not appear to kill the full-grown insects. It materially reduced the fly nuisance about the filters."

Twelve pounds of hypochlorite of lime were applied at the Plainfield plant through the dosing tanks on one day and the second day thereafter the dose was repeated. About 60 per cent of the larvæ disappeared. It seemed as if the first day's dosage killed or removed a part of the film and that the third day's dosage killed a large part of the larvæ. The incomplete kill resulting from this first treatment led to a trial of increased strength. Similar tests were made with 15, 30 and 50 pounds per acre. The kill being still incomplete, the 50-pound treatment was repeated three days in succession and gave a kill of about 85 per cent of the maggots. Many of the maggots appeared in the final tanks alive and fully 15 per cent remained in the filter bed unharmed. The film was considerably injured by the heavier treatments, particularly the last one.

Thus it is seen that the tests of chemical substances brought forward nothing of a satisfactory nature for the control of the sprinkling sewage filter fly.

Flooding

The senior author early in the study brought into the laboratory some of the filter stones, and, desiring to keep the material on them alive until the following day, covered them with tap water. When he undertook to resume examination of the film on the following day he found that all of the maggots of the sewage filter fly were dead. This accidental observation when correlated with the fact that the breathing tubes of the maggots and the pupæ projected through the film in such a way as to enable the creatures to obtain atmospheric air led promptly to the suspicion that the species could be destroyed by drowning.

Examination of the film for the purpose of determining the effect of the various chemicals upon it indicated that the other animal forms at least were such as to be resistant to such a process and the bacteriological studies made by various sewage disposal students indicated that the bacteria should be able to resist flooding for a considerable period of time. It was therefore determined to test submergence as a possible method of destroying the sewage filter fly.

Accordingly, a series of experiments were undertaken by the junior author to test out this method of destruction. In these experiments the filter stones with their covering of film were taken directly from the filter bed and placed in 6-inch burnt-clay non-glazed flower pots, the drainage hole of which was stopped up. An average of about one quart of stone was placed in each pot and the pots set into the bed so that their tops were practically flush with the surface. As the spray played, the pots became filled with water and the stone contained in them completely submerged. The length of time was the only variant. After the treatment was completed the stones were examined for signs of life in the larvæ and pupæ. The condition of the film was determined by making a smear on a glass slide and examing it under the microscope. The active forms of protozoa were used as an index to the life of the film. Putrefaction was determined by odor only. Table 3 sets forth the detail of the results.

Table 3

Results of Flooding Experiment Carried Out in Flower Pots

Length of time flooded	Condition of Larvæ and Pupæ	Condition of Film
16 hours	alive	alive
18 hours	alive	alive
22 hours	95 per cent dead	alive
24 hours	dead	alive
32 hours	dead	alive
36 hours	dead	slight putrefaction
48 hours	dead	putrefaction

This set of experiments was repeated three times with exactly the same results. It thus seemed that submergence for 24 hours destroyed 100 per cent of the larvæ and pupæ and apparently did not injure the film.

Realizing that the results in the flower pots might differ from results of the same treatment on the filter bed in this case as in others cited, we asked the Joint Sewer Committee to make the necessary preparations to submerge one quarter of the filter bed, involving somewhat less than half an acre. Although the problem of blocking off the drainage pipes from this section was a difficult one it was undertaken and carried out. The entire supply of effluent was turned into one dosing tank and run into this quarter of the filter. In 3 hours and 30 minutes after starting this quarter of the bed was submerged. The submergence was completed at 1.30 P. M. and the water was maintained on the bed continuously from that time until 1.30 the following day, when the sewage was turned from this quarter entirely into the other parts of the bed. In about two hours after the sewage was turned off this quarter, some of the stops were knocked out of the drains and samples of the effluent caught as it came from the treated section of the bed. Thousands of larvæ and pupæ, particularly larvæ were swept out and careful examinations of samples showed that 100 per cent were dead. For an hour after this time the senior and junior authors watched the effluent as it came from the filter into the final Imhoff tank. Constantly during this period the water swept by well filled with these dead larvæ and a smaller number of dead pupæ. In no case were any found to be alive. This submergence was completed on Saturday afternoon. The filter was allowed to stand without water over Sunday. The following Monday the stopping was all removed and the sewage turned back on this quarter of the bed as usual. Tests of the effluent of the filter for a week afterward by the manager of the plant, Mr. John R. Downs, indicated that the activity of the film had been in nowise impaired.

It thus seems that the sprinkling sewage filter fly, *Psychoda alternata,* and its less important relative *Psychoda cinerea*, may be destroyed by the simple process of submerging the sprinkling sewage filter for 24 hours with the ordinary sewage as delivered to the sprinkling filters without in any way impairing the efficiency of the film upon which the activity and efficiency of the sprinkling sewage filter depends.

Cranberry Investigations

Introduction

For several reasons the conduct of the cranberry investigations was this year turned over to the department of entomology, and arrangements were made whereby the full time of one man, Mr. Charles S. Beckwith, could be given to the work throughout the season. The following plan resulted from a conference at Whitesbog, N. J., called for the purpose of outlining the problems in cranberry culture which are most in need of investigation. This conference was participated in by various largely interested cranberry growers, a representative of the United States Department of Agriculture, the director of the New Jersey Agriculture Experiment Stations, Mr. Charles S. Beckwith and the Entomologist. It was decided that the purpose of these investigations is to make a search for the general principles upon which successful cranberry growing depends. It is hoped that the first season's work with this object in view may at least afford some clue to the methods which must be used in searching for these principles and that it may make some worth-while contributions to the practical work of cranberry culture.

It is believed that the general principles are concerned with the plant itself, plant-food, soil acidity, soil water and such limiting factors as weather, insects and fungi.

It was decided that the problems of plant-food, soil acidity, soil water and insects should be attacked during the present season and that problems concerned with the plant itself and such limiting factors as weather and fungi should be for the present disregarded. This limitation was the result of the fact that the time of the investigators concerned was limited. These problems were chosen from among the others because studies had already been begun on plant-food, soil acidity and soil moisture, and because the department was especially fitted to attack the insect question. The problems connected with strains and varieties of plants had already received sufficient attention to bring knowledge on that subject to a point not yet reached in plant-food, soil acidity and soil moisture, and the United States Department of Agriculture is still working on the problems of injurious fungi.

Plant-Food Problem

This problem is attacked with the assumption that the studies could be so arranged as to eliminate the variables of plant variety and strain, soil acidity, soil water, weather, insects and fungi to such an extent as to render the results comparable. Under these conditions the plant-food problem involves the determination of optimum amounts of nitrogen, phosphoric acid and potash for each of the soil types—Savanah, mud and iron ore—and of the best sources of these foods. For five seasons studies of these problems have gone forward and it now seems quite clear that while the Savanah bottom does respond, neither the mud nor iron ore shows any benefit except a slight one followed by the application of acid phosphate, phosphate rock, bone meal and steamed bone. In considering these results, it must be remembered that the applications were made in 1913, 1914, and 1915, and that because of super-abundant vine growth, no applications were given in 1916 and 1917. It must also be understood that the results of 1917 are not available, as the man who took them was drafted and failed to leave the data upon which the results could be computed.

Nitrogen

On the Savanah bottom. Nitrogen was secured from four sources, sodium nitrate, ammonium sulfate, dried blood and cotton-seed meal. The effect of nitrogen from various sources when applied alone is shown in table 4, in which we have an average annual crop from 1/20 acre.

Table 4

Value of Nitrogen of Various Sources

(Average for Four Years)

TREATMENT	Average yield	Average increase over check
	lbs.	lbs.
14 lbs. sodium nitrate 1913-1914-1915............	171.25	32.83
10 lbs. ammonium sulfate 1913-1914-1915........	144.37	5.95
20 lbs. dried blood 1913-1914-1915...............	185.48	47.06
30 lbs. cottonseed meal 1913-1914-1915...........	192.09	53.67
Check	138.42	

NOTE.—Results are taken by averaging crops of 1913, 1914, 1915 and 1916 together.

In the above table cottonseed meal is shown to be the best source and ammonium sulfate is shown to be the poorest source. As a matter of fact, the plants on the ammonium sulfate plots acted as if they had been poisoned and it is suspected that the sulfate was transformed into sulfuric acid, so increasing the acidity as seriously to damage the plants. Nitrogen was applied to Savanah bottom also in combination with phosphoric acid and potash. The results of these applications are set forth in table 5 on the basis of an average yield.

Table 5

Summary of Complete Fertilizer Results, Nitrogen from Various Sources Being Used on 1/20 Acre Plots

TREATMENT	Plot No.	Average yield	Average increase over checks
		lbs.	lbs.
14 lbs. sodium nitrate, 25 lbs. acid phosfate, 10 lbs. muriate of potash	9	234.69	91.55
10 lbs. ammonium sulfate, 25 lbs. acid phosfate, 10 lbs. muriate of potash	11	167.92	24.78
20 lbs. dried blood, 25 lbs. acid phosfate, 10 lbs. muriate of potash	13	287.41	144.27
30 lbs. cottonseed meal, 25 lbs. acid phosfate, 10 lbs. muriate of potash	15	295.94	152.80
Check—nothing	10	143.14	
	12 14 16		

From table 5, we again note that the greatest average increase was made with cottonseed meal as the source of nitrogen, and that the poorest return came from ammonium sulfate.

On mud and iron ore bottoms. The returns from the use of nitrogen from all sources on the mud and iron ore bottoms were so unsatisfactory as to render the presentation of a tabular statement not worth while.

Phosphoric Acid

On Savanah bottom. Phosphoric acid was secured from four sources: acid phosphate, basic slag, rock phosphate and steamed bone. The results of the use of phosphoric acid from each of these sources applied separately are set forth in table 6.

Table 6

Value of Phosphoric Acid from Different Sources (Average for 4 Years)

TREATMENT	Average yield	Average increase over-checks
	lbs.	lbs.
25 lbs. acid phosphate 1913-1914-1915	198.34	94.49
25 lbs. basic slag	129.28	25.43
15 lbs. rock phosphate	146.47	42.62
15 lbs. steamed bone	142.75	38.90
Check	103.85	

The table indicates that the best results came from the use of acid phosphate and the poorest from basic slag. Phosphoric acid was used also in combination with other fertilizers. The results of this trial are set forth in table 7.

Table 7

Summary of Complete Fertilizer Results with Phosphoric Acid From Various Sources

TREATMENT	Plot No.	Average yield	Average increase
		lbs.	lbs.
25 lbs. acid phosphate, 10 lbs. ammonium sulfate, 10 lbs. muriate of potash	9	234.69	91.55
25 lbs. basic slag, 14 lbs. sodium nitrate*, 10 lbs. muriate of potash	27	249.85*	89.24
15 lbs. phosphate rock, 10 lbs. sodium nitrate*, 10 lbs. muriate of potash	29	208.97	48.36
15 lbs. steamed bone, 10 lbs. sodium nitrate*, 10 lbs. muriate of potash	31	222.21	61.60
Check	26-28 30-32	160.61	

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*Sodium nitrate was used as a source of nitrogen on these plots to prevent acid action of ammonium sulfate on basic slag, and this may have been a deciding factor.

It thus appears that when used in combination phosphoric acid from acid phosphate gives the best results, and from phosphate rock the poorest results.

Mud and iron ore bottoms. The results of the application of phosphoric acid in its various combinations to mud and iron ore bottoms are so variable as to render their presentation not worth while.

Potash

On Savanah bottom. The potash was secured from three sources, muriate of potash, sulfate of potash and kainit.

Table 8

Value of Potash from Different Sources on 1/20 Acre Plots (Average for 4 Years)

TREATMENT	Average yield	Average increase over-checks
	lbs.	lbs.
10 lbs. muriate of potash 1913-1914-1915..........	150.80	18.95
10 lbs. sulfate of potash 1913-1914-1915..........	148.84	16.99
42 lbs. kainit 1913-1914-1915....................	144.44	12.59
Check	131.85	

This table shows only slight increases; the best coming from muriate of potash and the poorest from kainit. Potash was used in combination with other fertilizers, and results are set forth in table 9.

Table 9

Summary of Results From Complete Fertilizers, with Potash From Varying Sources

TREATMENT	Plot No.	Average yield	Average increase over-checks
		lbs.	lbs.
10 lbs. muriate of potash, 10 lbs. sulfate of ammonia, 25 lbs. acid phosphate	9	234.69	91.55
10 lbs. of sulfate of potash, 10 lbs. of sulfate of amonia, and ...... 25 lbs. acid phosphate	39	202.38	55.67
42 lbs. kainit, 10 lbs. sulfate of ammonia, 25 lbs. acid phosphate	41	164.19	17.48
Check	40, 42	146.71	

The best results here came from the potash applied as muriate and the poorest from the potash applied as kainit.

On mud and iron ore bottoms. The results of potash applied either alone or in combination with other fertilizers on these types of bottom are so variable and unimportant as to render a presentation of them not worth while.

Conclusions on Previous Work on Plant-foods and Plans for New Work

Certain facts stand out as the results of tests of 1913, 1914, 1915 and 1916. The fertilizers gave marked results in increased yield on Savanah bottom. The best results followed the use of nitrogen and the poorest the use of potash. On mud and iron ore bottoms the results were varying and unsatisfactory. The fertilizers induced a super-abundant vine-growth, indicating that the amount applied was too great. It was, therefore, decided to discontinue plant-food treatments on mud and iron ore bottoms and to decrease the amount annually applied to Savanah bottom by 50 per cent. In accordance with this plan, the following schedule of treatments has been adopted for the Savanah bottom and the materials have been applied.

Plot No.
1. 7 pounds nitrate of soda.
2. Nothing.
3. 5 pounds ammonium sulfate.
4. Nothing.
5. 10 pounds dried blood.
6. Nothing.
7. 15 pounds cottonseed meal.
8. Nothing.
9. 7 pounds nitrate of soda, 12½ pounds acid phosphate.
10. Nothing.
11. 5 pounds ammonium sulfate, 12½ pounds acid phosphate.
12. Nothing.
13. 10 pounds dried blood, 12½ pounds acid phosphate.
14. Nothing.
15. 15 pounds cottonseed meal, 12½ pounds acid phosphate.
16. Nothing.
17. 12½ pounds acid phosphate.
18. Nothing.
19. 12½ pounds basic slag.
20. Nothing.
21. 7½ pounds rock phosphate.
22. Nothing.
23 7½ pounds steamed bone.

24. Nothing.
25. 15 pounds bone meal (2-30) 5 pounds ammonium sulfate.
26. Nothing.
27 12½ pounds basic slag, 7 pounds nitrate of soda.
28. Nothing.
29. 7½ pounds phosphate rock, 5 pounds ammonium sulfate.
30. Nothing.
31. 7½ pounds steamed bone, 5 pounds ammonium sulfate.
32. Nothing.
33. Nothing.
34. Nothing.
35. Nothing.
36. Nothing.
37. Nothing.
38. Nothing.
39. 7 pounds nitrate of soda, 12½ pounds acid phosphate.
40. Nothing.
41. 7 pounds nitrate of soda, 12½ pounds of acid phosphate.
42. Nothing

Soil Acidity

At the outset of the plant-food studies in 1913, the assumption that the degree of acidity favorable to the growth and productiveness of the cranberry plant was unimportant so long as the soil is at all acid, was thought worthy of test. Some very small plots (1/200 acre in size) were laid out on the Savanah and mud bottoms and treated with copper sulfate, manganese sulfate, sulfur, ground limestone and ground burned lime. This treatment was repeated in 1914 and the results on the yields were taken in 1915 and 1916.

On Savanah bottom. Copper sulfate was applied at the rate of 25 pounds, 50 pounds and 100 pounds per acre. The 25 pounds and 100 pounds showed slight increases and the 50 pounds showed rather larger decreases. The variation in results is within the limits of experimental error and it, therefore, seems proper to assume that the copper sulfate showed no particular effect. The manganese sulfate was applied at the rate of 100 pounds, 200 pounds, 400 pounds and 800 pounds. The results are like those of the copper sulfate. Ground sulphur was applied at the rate of 100 pounds, 200 pounds, 400 pounds and 800 pounds. The first two showed variable results but the last two showed a decided reduction in yield and at one point completely destroyed the cranberry plants. The ground limestone was applied at the rate of 1,000 pounds, 2,000 pounds, 4,000 pounds and 8,000 pounds per acre. In 1915 all ground limestone applications showed a decided increase in yield, but in 1916 the returns were small and variable. This is probably due to the short crop in 1916. The ground burned limestone was applied at the rate of 500 pounds, 1,000 pounds, 2,000 pounds and 4,000 pounds. In 1915 practically all showed benefit, the 1,000-pound treatment giving the best results. In 1916 the gains were small and uncertain.

On mud bottoms. The results of treatment on mud bottoms were much the same as those on the Savanah bottoms, although the increases were not so pronounced.

It thus appears that the copper sulfate and manganese sulfate, both of which would not only certainly not decrease but would probably increase the acidity, do not increase the crop and in some cases actually largely decrease it. It also appears that lime tends to increase the crop both on Savanah and mud bottoms. From these facts we may conclude that the present degree of soil acidity is too high and that the optimum crop results are likely to follow a reduction.

Accordingly, this year a series of 1/20-acre plots were laid out on savanah and mud bottoms for the purpose of determining the amount of lime needed to produce the optimum degree of acidity. A test of the sources of lime was included by using non-magnesium and magnesium lime rock and burned lime. The plan follows:

July 5, 1918.

Lime applications were made to the Savanah series of lime plots which were newly laid out last week. Lime plots consist of ten 1/20-acre plots, each 1 rod wide and 8 rods long numbered from east to west. Applications were as follows:

Plot No.

1. Nothing.
2. 50 pounds pulverized limestone (non-magnesium).
3. 50 pounds pulverized limestone (magnesium).
4. Nothing.
5. 100 pounds pulverized limestone (non-magnesium).
6. 100 pounds pulverized limestone (magnesium).
7. Nothing.
8. 200 pounds pulverized limestone (non-magnesium).
9. 200 pounds pulverized limestone (magnesium).
10. Nothing.

July fifth was slightly cloudy and the light breezes blew from the west. There was a full bloom on the cranberry plants.

July 6, 1918.

Lime applications were made to the mud series of lime plots newly laid out last week. Lime plots consisted of ten 1/20 acre plots, each 1 rod wide and 8 rods long, numbered from the east to the west. Applications were as follows:

Plot No.

1. Nothing.
2. 50 pounds pulverized limestone (non-magnesium).
3. 50 pounds pulverized limestone (magnesium).
4. Nothing.
5. 100 pounds pulverized limestone (non-magnesium).
6. 100 pounds pulverized limestone (magnesium).
7. Nothing.
8. 200 pounds pulverized limestone (non-magnesium).
9. 200 pounds pulverized limestone (magnesium).
10. Nothing.

The plants were just past full bloom, a heavy mat of vines was on the ground and some spots had a little grass growing through. The day was cloudy. There was a very slight east wind.

Soil Moisture

The fact that differences in plant growth of both the cranberry plants and of the weeds (grass and weeds) which affect them, seem to be correlated with the height of water table and soil moisture, led to the formation of a plan to investigate the underlying causes. Of course, the first step in a study of this sort is to establish the fact and the degree of correlation that appears to exist.

For this purpose a piece of bog having both Savanah and mud bottoms and both well and poorly drained sections was chosen. Thirty points arranged in three lines running crosswise over the different types of bottoms are to be laid out. At each point a heavy survey stake is to be driven in. The tops of these stakes will be set to common level and will correspond to the water level of the Swain drainage ditch at the outlet. Data on the height of water table, the amount of soil moisture for each inch between the surface and the water table, and the species and vigor of plants will be taken at least once each week throughout the season.

The data taking will close with the flooding of the bogs and the results will be correlated.

Insect Enemies

The work on insects this year will be of a general survey nature, with especial attention to tip worm and others as the occasion demands.

Eggs of Apple Aphides

Alvah Peterson

During the dormant season of 1916-17, a careful preliminary study was made of the eggs of three species of aphides found on apple trees, *Aphis avenæ* Fabr., *Aphis pomi* De. G., and *Aphis sorbi* Kalt. Particular attention was paid to the structure of the egg covering and the behavior of the eggs during the hatching period and their response to environmental factors such as moisture and temperature and to common contact insecticides and other chemicals. During the past season (1917-18) these studies were continued with the eggs of *A. avenæ* (the eggs of *A. Pomi* and *A. sorbi* were not available). A preliminary report on the results obtained during 1916-17 may be found in the December number (1917) of the Journal of Economic Entomology and a more complete report in Bulletin 332 of the New Jersey Agricultural Experiment Stations. In this report only a summary of the new and most important features of the investigation will be given.

A morphological study of the eggs of all three species of apple plant lice shows two distinct layers in the egg shell, an outer, semi-transparent layer which is soft and glutinous when the egg is deposited, but hardens and becomes tough (may be brittle) and impervious upon long exposure to weather, and an inner soft, elastic, black membrane. A third layer, thin and membraneous, may be seen about the nymph when it starts to emerge. This is probably the first cast skin (exuvium) of the growing nymph.

The outer layer about the egg usually splits along the dorso-mesal line a number of days before the nymph emerges. The eggs of *A. avenæ* show a split outer layer 2 to 30 days or more before the inner pigmented layer is severed by the nymph. In 1918 the first eggs of *A. avenae* split their outer coverings on February 15 and when the first nymphs emerged on March 21, approximately 95 per cent of the normal live eggs (45-50 per cent of the eggs were dead) showed a split outer semi-transparent covering. The increase in the number of eggs that showed a split outer layer was gradual and progressive from the first warm days after February 15 until the nymphs emerged. So far as observed no nymph hatches without splitting the outer layer at least 48 hours or more before it severs the inner pigmented elastic membrane.

The observations on the morphology and behavior of the egg coverings show conclusively that the egg is not a hard resistant body and that it goes through a critical change previous to the emergence of the nymph. It is in the midst of these changes or critical period that the egg is most susceptible to evaporating factors and certain contact insecticides.

The outer semi-transparent layer of the egg is somewhat impervious to water, consequently, the water content of the embryo does not evaporate as rapidly in moist weather or, in other words, when low evaporating factors exist, such as high humidity, low temperature and probably small wind velocity. The outer layer however, is not entirely impervious, for extreme drought will cause the vast majority (95 to 100 per cent) of normal eggs to shrivel and never hatch. In brief, low humidity, high temperature and probably high winds cause the evaporation of the water content of the embryo within the egg and thus destroy a large number of them.

The inner pigmented (black) layer of the egg is not an efficient protector against evaporation. Numerous and varied experiments at the laboratory and observations made on the percentage of hatched eggs of *A. avenae* during the two totally different seasons of 1917 and 1918 show conclusively the pervious nature of this layer.

The eggs are most susceptible to evaporating factors and contact insecticides during the latter part of March and the first part of April or, in other words, when the greatest number show a split outer layer, and this occurs when the first nymphs commence to emerge.

Experiments conducted in the laboratory in incubators under controlled temperatures and percentages of moisture and also experiments where eggs of *A. avenæ* were kept out-of-doors during the critical period (February 15 to March 31, especially important March 15-31) in 1917 which was cold and wet, and in 1918 which was warm and dry, show conclusively that the percentage of hatched eggs is much higher in a low evaporating (cold and wet) environment than in a high evaporating (warm and dry) environment.

Contact insecticides probably prevent the egg from hatching in several ways. From a physical viewpoint some substances (lime-sulfur) tend to harden the outer semi-transparent layer and this makes it impossible for the nymphs to split the hardened shell. This hardening effect may be due to dessication. Dessicating substances may also remove the water content of the embryo, especially if applied after the outer layer is split. Other substances soften and disintegrate the outer impervious layer (crude carbolic acid and cresols) and thus expose the inner pigmented layer to evaporating factors. The above physical reactions of contact insecticides on the eggs of aphides may be important, but it is probable that the toxic effect of the various contact insecticides on the embryo is more important. So far, no technique has been found which will determine the penetrative ability of the various chemicals used and their toxic influence.

Control

As the result of the various experiments conducted at the laboratory and in various orchards throughout the state we can safely recommend as a control measure for aphides a delayed dormant spray of lime-sulfur 1 to 8 or 1 to 9, combined with 40 per cent nicotine ("Black leaf 40") 1-500. The combined spray kills 98 to 100 per cent of all the eggs that are coated and will also kill all the newly-hatched nymphs provided they are hit. Dormant lime-sufur by itself will kill a large percentage (90 per cent or better) of the eggs but not enough to warrant its use alone. Lime-sulfur 1 to 8 or 1 to 9 alone will kill only a small percentage of the newly-hatched nymphs. A combined spray is better, for it will kill almost all of the unhatched eggs and all the young nymphs.

The time of application is important. In the foregoing summary it was shown that the egg is most easily killed after the outer layer has split and it was also pointed out that the greatest number of eggs showed a split outer shell just as the first nymphs start to emerge. The first nymphs of *A. avenæ* emerged in 1917 and 1918 as the fruit buds were swelling, just prior to the time when the first green can be seen. The eggs of *A. pomi* and *A. sorbi* in 1917 did not emerge for 7 to 14 days after the buds started to swell on the early varieties of apples. With the above facts in mind one can get the best results by delaying the dormant spray until the buds are swollen and first show green. The dormant spray will not injure swollen fruit buds or those with short projecting tips of leaves, but an application after these stages have passed when the leaves are quite distinct and separated will burn the foliage of most varieties. It is also more difficult to hit all the young nymphs when the leaves are distinct and separated, for they are more or less protected by the leaves. In case one fails to obtain complete control with dormant strength one may use 40 per cent nicotine 1 to 500, and fish oil soap (2-5 pounds to 50 gallons of water). This will kill all the nymphs that are hit and will not injure the foliage. In case all the eggs have not hatched this mixture will not kill over 75 per cent of the eggs.

A miscible oil, "Scalecide" 1 to 15, has been given a thorough trial in the orchard and at the laboratory, but it has not produced satisfactory results. Some eggs are killed by this material, but it does not give as good control as a combined dormant lime-sulfur and nicotine spray. Other miscible oils were tried and it was observed that those possessing carbolic acid derivatives (Mechling's Scale Oil) gave a more perfect control than miscible oils free from carbolic acid derivatives, such as "Scalecide". Crude carbolic acid and cresol combined with miscible oils will kill a large percentage of eggs, but there is some indication that an amount of acid present in the oil in sufficient quantity (2 per cent of spray) to kill all the eggs may be detrimental to dormant buds.

Other contact sprays such as a strong solution of fish oil soap, 1 pound to 6 gallons of water, combined with nicotine 1 to 500, or with crude carbolic acid (1.5 to 2 per cent), give considerable promise of becoming effective sprays for the control of aphides in the egg stage when applied near the time when the first nymphs emerge.

Any soap spray spreads better than lime-sulfur and for this reason they may prove to be more efficient. Crude carbolic acid (5 per cent) or cresol U. S. P. (2 per cent) combined with fish oil soap will not injure dormant buds of apple trees, so far as observed.

Peach Tree Borer

Experiments With Tarred Paper Collars and Other Substances

ALVAH PETERSON

During the summer of 1917 a careful study was made of the feeding and oviposition habits of the adult peach tree borer *Sanninoidea exitiosa* Say, at Clementon, N. J., in the James M. Moon and Son's 80-acre peach orchard. A number of spraying experiments were conducted also with the eggs. The results of these investigations were very interesting, but they were largely negative in so far as they may develop a much needed control measure (see N. J. Agr. Exp. Sta. Ann. Rpt. 1917).

In addition to the above investigations a number of mechanical and chemical barriers were placed on or about the trunks of numerous peach trees with the idea of preventing the female adult from depositing eggs on the tree and keeping the young larvæ out of the tree. The most extensive set of experiments along this line was the use of tarred paper collars, commercially called "Scott's tree protectors." These were placed about the base of 75 or more 8 to 10-year-old trees in three distinct portions of the peach orchard. A similar lot of trees were selected in each part of the orchard for checks and they received the same treatment as the former trees, except that the collars, or protectors, were not used.

During November, 1916, all the trees in the orchard were bored for larvæ by the owner. Again in the early part of June, 1917, the dirt was pulled away (6 to 10 inches deep) from all the trees used in the various experiments and they were "wormed" twice, the first time about ten days after the dirt was removed and the second time ten days after the first "worming." In these two borings a large number of larvæ were removed which varied considerably in size, but one is unable to remove all the larvæ by digging for them, provided one does not wish to injure the tree any more than can be helped. In the autumn the larvæ coming from eggs deposited late in the summer of the same year are too small to be readily seen and thus they easily escape detection. This is true, also, to some extent, in the spring of the year. In the early part of the year one can find some larvæ that are full-grown. These apparently come from eggs deposited late in the summer two years previous. In other words, large larvæ found late in the spring of 1917 came from eggs deposited during the latter half of the summer of 1915. The above assumption in respect to the age of the full-grown larvæ found in the spring of the year explains some of the results obtained after one season's use of the tarred paper collar. The prolonged development of some of the larvæ and the difficulty of removing all of them by boring makes it next to impossible to determine definitely the value of any mechanical or chemical protector in one year. Consequently, a conclusive statement on the value of a tarred paper disc is not possible at this time. However, the results obtained after one year's trial are of such a nature as to indicate what may be expected in another season. All the tarred paper collars have been replaced (June, 1918) on the same trees and in another season their value will be more conclusively shown.

In these experiments two sizes of tarred collars were used in order to fit the different-sized trees. The tarred paper protectors were purchased from Thomson Chemical Company, Baltimore, Md., but one can make them readily from tarred roofing paper. From 60 to 70 protectors, according to size, can be cut from a roll of tarred roofing paper (104 square feet in roll). The diameters of the two collars used were 15 inches and 17 inches and the diameters of the inner circles or holes were 4 inches and 5 inches, respectively About the inner circle at intervals of ½ to ¾ inch cuts ¾ to 1¼ inch deep were made along the radii and one cut was continuous from the inner circle to the outer margin of the collar. When the trees were ready for the protectors the dirt was piled up about the base of the tree (4 to 6 inches), firmly packed down and made smooth with a wooden paddle. The collar was then placed about the tree and made to fit snuggly against the tree and the cone-shaped mound of dirt. A strong wire paper-clip was placed on the outer margin of the collar where the edges overlapped. The use of the clip proved to be very important for it holds the protector in place and thus relieves the strain from the sealing material.

Two subtsances were used to seal the overlapping edges of the protector and the protector to the tree. These were "borene," a coal tar product, put out by the same firm that makes the Scott's tree protector and "Liquid Lap Cement," an asphaltic compound, manufactured by the Barber Asphalt Paving Company, Maurer, N. J. The last-mentioned material when purchased is a heavy liquid and it is necessary to boil this material for several hours (6 to 12) in order to reduce it to the proper consistency. After the protectors were placed about the trees the sealing material was heated in an iron heater until the material became soft enough to be applied with a wooden paddle. The sealing material was first applied between the overlapping edges of the protector without removing the paper clip and then about the inner circle adjacent to the tree thus sealing all openings between the protector and the tree. Just enough material was used to complete the seal, and as a rule the sealing material did not extend on the tree over one inch above the inner margin of the protector. The so-called "borene" was applied to all the protectors in the north-eastern part of the orchard and to four in the south-western part. All remaining protectors were sealed with "Liquid Lap Cement." The latter proved to be the best and most economical. It spreads more readily and consequently does not require as much material to complete the seal. All the protectors were sealed for the first time on June 28-29, 1917, and a careful watch was kept for the appearance of any cracks in the seals. On July 26, 1917, the majority of the protectors in the north-eastern part of the orchard showed a number of small cracks in the "borene," while only five protectors out of 45 or more in other parts of the orchard which were sealed with "Liquid Lap Cement" showed any cracks. On July 27 all the protectors were gone over with a thin coating of Liquid Lap Cement and during the remainder of the season each protector was carefully inspected and, so far as observed, no cracks or openings of any description occurred. In other words the seals were nearly perfect and this in large measure is due to the use of a strong wire clip. Former trials with similar tree protectors by this station and other entomologists, where no paper clip was used, showed a serious cracking in the seal a short time after it was applied and there was considerable difficulty in retaining a good seal even though the protectors were resealed several times during a season.

At the end of the season, in November, the trees were bored and at this time only a few large larvæ were found. The small larvæ coming from eggs laid in 1917 were too small to be readily seen. Again in May and June, 1918, the trees were examined for larvæ and on May 23-24 the largest number were found. The dirt was pulled away from the trees on May 10 and they were allowed to stand until May 23-24 before digging out the larvæ. The larvæ were removed from points on the tree wherever the gum and excrement could be seen, Again on June 4 the trees were examined for borers and at this time about one-third as many larvæ were found as on May 23-24. Also, many more larvæ were found at this time than in November, 1917.

Table 10 gives the size and the number of larvæ and fresh channels (no larvæ seen in these) for each tree experimented upon. In digging out the larvæ from the trees, one can easily overlook or destroy the worm with the instrument used in boring and not be aware of it, consequently, it was thought best to keep a record of the fresh channels where excrement and gum were present but no larvæ seen. The number of larvæ have been recorded according to size for the sake of showing the great variation in the size of the larvæ at any one time of the year. Since 80 to 90 per cent of the larvæ were removed in May and June, this gives a good idea of their size at this time of the year.

The trees with protectors on them are indicated by the letter *p* while the check trees are distinguished by *ch*. The protectors were used in three parts of the orchard (*S. E.*, *S. W.* and *N. E.*) In the *S. E.* and *S. W.* parts the soil is light and sandy, especially in the *S. W.* portion, while in the *N. E.* portion the soil is heavy, dark colored and possesses a considerable amount of gravel. Trees of the same age in the *N. E.* part of the orchard as in other parts are larger and healthier in appearance. The infestation of borers was least severe in this part, while the heaviest infestation occurred in the *S. W.* portion where the soil is largely white sand. This percentage of infestation for the various parts of the orchard closely corresponds with Mr. Moon's experience in boring for the larvæ in past years.

Table 10

Size, Number of Larvae and Fresh Channels Found in Each Tree After One Season. (p=Protector About Tree and ch=Check—no Protector)

TREE No.	Larvæ ¼—½ inch	Larvæ ½—¾ inch	Larvæ ¾—1 inch	Fresh channels	Total larvæ and channels
1—p	0	0	0	1	1
2—p	0	0	0	0	0
3—p	0	0	0	0	0
4—p	0	0	0	0	0
5—p	0	0	0	1	1
6—p	0	0	0	0	0
7—p	0	0	0	0	0
8—p	0	0	0	0	0
9—p	0	0	0	0	0
10—p	0	0	0	0	0
11—p	0	0	0	1	1
12—p	0	0	0	0	0
13—p	0	0	0	0	0
14—p	0	0	0	0	0
15—p	0	0	0	0	0
16—p	0	0	0	0	0
17—p	0	0	0	0	0
18—p	0	2	2	2	6
Total	0	2	2	4	8
19—ch	0	1	0	2	3
20—ch	0	2	1	1	4
21—ch	0	0	0	1	1
22—ch	3	1	1	0	5
23—ch	0	3	0	0	3
24—ch	0	1	0	2	3
25—ch	1	2	0	2	5
26—ch	0	3	0	1	4
27—ch	0	0	0	1	1
28—ch	3	3	1	0	7
Total	7	16	3	10	36
29—p	0	0	0	2	2
30—p	0	7	0	0	7
31—p	0	0	0	0	0
32—p	0	0	1	0	1
33—p	0	0	1	1	2
34—p	0	4	0	2	6
35—p	0	0	0	0	0
36—p	0	0	0	0	0
37—p	0	0	0	0	0
38—p	0	0	0	4	4
39—p	0	0	0	0	0
40—p	0	0	0	0	0
41—p	0	0	0	0	0
42—p	0	1	0	0	1
43—p	0	0	0	0	0
44—p	0	0	2	0	2
45—p	0	0	0	0	0

Table 10—Continued

TREE No.	Larvæ ¼—½ inch	Larvæ ½—¾ inch	Larvæ ¾—1 inch	Fresh channels	Total larvæ and channels
46—p	0	1	0	0	1
47—p	0	0	0	0	0
48—p	0	0	0	0	0
49—p	0	0	0	0	0
50—p	0	0	0	0	0
51—p	0	1	1	0	2
52—p	0	1	0	0	1
53—p	0	0	2	0	2
54—p	2	1	0	0	3
55—p	0	0	1	1	2
56—p	0	0	0	0	0
57—p	0	0	1	0	1
58—p	0	0	0	0	0
59—p	0	0	1	0	1
Total	2	16	10	10	38
60—ch	0	3	1	3	7
61—ch	1	2	5	1	9
62—ch	0	6	1	4	11
63—ch	0	4	0	2	6
64—ch	0	3	1	2	6
65—ch	0	3	0	2	5
66—ch	0	2	0	0	2
67—ch	0	2	1	0	3
68—ch	1	2	2	0	5
69—ch	0	0	0	3	3
70—ch	0	2	0	1	3
71—ch	0	2	1	0	3
72—ch	1	0	1	0	2
Total	3	31	13	18	65
73—p	0	0	0	0	0
74—p	0	0	1	1	2
75—p	0	0	0	1	1
76—p	0	0	0	0	0
77—p	0	0	0	0	0
78—p	0	0	0	0	0
79—p	0	0	0	0	0
80—p	0	0	0	0	0
81—p	0	0	0	0	0
82—p	0	0	0	0	0
83—p	0	0	0	0	0
84—p	0	0	0	0	0
85—p	0	0	0	0	0
86—p	0	0	0	0	0
87—p	0	0	0	0	0
88—p	0	0	0	0	0
89—p	0	0	0	0	0
90—p	0	0	0	0	0
91—p	0	1	0	0	1
92—p	0	0	0	0	0
93—p	0	0	0	0	0
94—p	0	0	0	0	0
95—p	0	0	0	0	0
96—p	0	0	0	0	0
Total	0	1	1	2	4

Table 10—Continued

97—ch	0	3	0	0	3
98—ch	0	1	1	0	2
99—ch	0	2	0	0	2
100—ch	0	1	0	0	1
101—ch	0	0	0	0	0
102—ch	0	0	0	1	1
103—ch	0	0	0	3	3
104—ch	0	1	0	1	2
Total	0	8	1	5	14

Table 11

Condensed Form of Table 10, Showing Total and Average Number of Borers (b.); and Channels (c); for All the Trees (tr.) in Each Section of the Orchard

	¼-½ inch larvæ (b.)		½-¾ inch larvæ (b.)		¾-1+inch larvæ (b.)		Fresh channels (c.)		Average number of larvæ and channels per tree	Per-centage of infestation
	larvæ trees (tr.)	larvæ per tree	larvæ trees (tr.)	larvæ per tree	larvæ trees (tr.)	larvæ per tree	Chan. tree (tr.)	Chan. per tree		
Protectors—S. E.	0 b.	0.00	2 b.	0.11	2 b.	0.11	2 c.	0.11	0.33	9.1
Expt., 1p-18p	18 tr.		18 tr.		18 tr.		18 tr.			
Checks—S. E.	7 b.	0.70	16 b.	1.60	3 b.	0.30	10 c.	1.00	3.6	100.0
Expt., 19ch-28ch	10 tr.		10 tr.		10 tr.		10 tr.			
Protectors—S. W.	2 b.	0.06	16 b.	0.51	10 b.	0.32	10 c.	0.32	1.21	24.2
Expt., 29p-59p	31 tr.		31 tr.		31 tr.		31 tr.			
Checks—S. W.	3 b.	0.23	31 b.	2.38	13 b.	1.00	18 c.	1.38	4.99	100.0
Expt., 60ch-72ch	13 tr.		13 tr.		13 tr.		13 tr.			
Protectors—N. E.	0 b.	0.00	1 b.	0.04	1 b.	0.04	2 c.	0.08	0.16	9.1
Expt., 73p-96p	24 tr.		24 tr.		24 tr.		24 tr.			
Checks—N. E.	0 b.	0.00	8 b.	1.00	1 b.	0.12	5 c.	0.62	1.74	100.0
Expt., 97ch-104ch	8 tr.		8 tr.		8 tr.		8 tr.			

Experiments 1p-18p and 19ch-28ch were conducted in the *S. E.* part of the orchard (sand soil), experiments 29p-59p and 60ch-72ch in the *S. W.* part (very light sand soil) and experiments 73p-96p and 97ch-104ch in the *N. E.* part (heavy gravel soil). Table 11 summarizes the results of table 10 and gives the average number of larvæ of each of three sizes per tree and the average number of fresh channels per tree and the total average number of larvæ and channels per tree for each section of the orchard. In all cases the number of larvæ per tree where protectors were used was geatly reduced (76 to 90 per cent). The protectors in the *S. E.* and *N. E.* parts of the orchard reduced the infestation 90 per cent, and 75 per cent in the *S. W.* portion. In this table it should be noted that many of the larvæ found under the protectors were almost full grown and these were undoubtedly present in the tree when the protectors were applied.

The above reduction in the percentage of larvæ where tarred paper collars were kept sealed about the base of the tree gives us a preliminary indication of their value in keeping the larvæ out of the trees. It will require two or more seasons to determine the final value of the tarred paper card.

Other Substances.—A number of experiments were tried with various chemicals or common spray materials by spraying the same on the trunks of trees at intervals of ten days to two weeks. In all cases the number of small larvæ present in the spring of the year apparently indicates their ineffectiveness. Fifteen trees were treated with nicotine resinate, 1 part to 100 of water. Ten of these received only one treatment, on July 16, while five of them were treated on July 16, August 1, and August 16. The material was sprayed on the main trunk of the tree and the larger branches above ground and on the trunk of the tree six inches below the surface of the ground. One gallon was sufficient to soak thoroughly the outer bark of five trees. So far as observed, the material did not injure the tree nor was it effective in reducing the number of larvæ. It has been shown that nicotine resinate has good lasting qualities, and for this reason it was thought that it should be effective in keeping the larvæ out of the tree.

The trunks of ten trees were sprayed with "Scalecide," 1 to 15, on July 25, August 6 and August 18. In using this material care was taken only to wet the trunk of the tree above ground without allowing any large surplus to soak into the ground about the crown of the tree. So far as observed, no injury resulted from this treatment and the number of larvæ (large and small) was not materially reduced. This series of experiments, however, is by no means conclusive, for the material was not applied early enough during the summer season to keep out all the larvæ. The main object of the experiment was to determine the repellant effect of "Scalecide" on the adult moth, but other experiments on the insects in cages show the ineffectiveness of this material in respect to this point.

The trunks of ten trees were sprayed with three applications (July 25, August 6 and August 18) of "Scalecide" 1 to 20, plus crude carbolic acid (1 per cent) and ten others with three applications of fish oil soap (1 pound to 25 gallons of water) plus crude carbolic acid (1 per cent). The chief purpose of these experiments was to determine the effect of the material on the peach tree. So far as observed, there was no injury. The number of larvæ was not materially reduced; however, this is not a conclusive test for this material.

REPORT ON MOSQUITO WORK

Thomas J. Headlee

Owing to the shortening of the fiscal year there is little to report in the way of additional drainage. The bulk of this work is yet to be done and practically none that has been done is ready to report. The usual tabular matter relative to drainage will therefore be omitted, and included in next year's statetment.

One contract for 275,862 linear feet (100,000 feet of ditches 10 inches wide by 15 inches deep and 175,862 feet of ditches 10 inches wide and 26 inches deep) was let to the United States Drainage Irrigation Company at $9,600. The price is higher than it has been necessary previously to pay, but the increased cost of labor and apparatus seemed to justify the increased figure.

The areas to be drained are located in Ocean and Cape May counties. The first includes the marsh lying alongside the sand strip from Barnegat City lighthouse to Surf City and the second the salt marsh from Schooner's Creek south of the Tuckahoe River westward to Job's Creek.

The principal attention of the entomologist and his assistants has been given to the preparation of plans for mosquito control in connection with the counties, ordnance depots, loading plants and shipbuilding yards.

County Mosquito Work

Hudson, Bergen, Passaic, Morris, Essex, Union, Middlesex, Ocean, Atlantic and Cape May counties have continued in the work during the present season. Hudson, Bergen, Essex, Union and Atlantic counties are continuing their effort against all species of mosquitoes which breed within their limits. Passaic is fighting all species of mosquitoes which occur in the southern half of the county.

Middlesex, Monmouth, Ocean and Cape May counties are devoting practically their entire attention to the salt-marsh mosquito problem. Morris is making a survey of the mosquito breeding places with a view to the formulation of plans for attacking the problem as a whole.

The period involved in this report includes the inactive season which runs from November first to April first. During the active portion of the season, a large amount of work has been accomplished in these various counties, but the data relative to it are not now at hand and cannot be included in this report.

Outlet for the Southern End of the North Arlington Meadow and of the Triangular Area Extending Between the Belleville Turnpike and the Greenwood Lake Branch of the Erie Railroad from the Highland to the West to the Junction of the Two Roads

The second area mentioned lies entirely and the first fully half in Hudson County. The second has been a prolific breeder of *sylvestris* and during the early part of the season of *cantator*. The first has been a prolific breeder of *cantator*. The sole outlet for the second is a ditch passing under the Bellville Pike, only a few hundred feet from the highland. The present outlet permits the water to disappear from the surface of the first area only after the first and sometimes the second broods have emerged. The present outlet is not sufficient even to remove the water from all the surface of the second area.

Without doubt the present choked-up condition of Saw Mill Creek is partly responsible, but the present tide-gate outlet will not remove promptly all the water which the creek carries down when the meadows carry much water on the surface. Two 3 by 6-foot flumes are thought to be necessary to remove the rain-water, and one additional 3 by 6-foot flume has been added to provide for the waste water which is thrown into the stream from the Arlington Celluloid Works. The outside cost of the flumes and gates is $3,000 of which the Arlington Celluloid Works has agreed to bear one-half, the other half to be borne jointly by Bergen and Hudson counties.

It is proposed to have the plans and specifications prepared in the office of the entomologist and to carry out the work under a joint committee.

Area of Kearney Marsh Extending Between Frank Creek and the Highland to the West from the Harrison Turnpike to the Junction of Frank Creek and the Joint Sewer

For many years this area which is more or less sewage-soaked has been a prolific breeder of *pipiens,* supplying not only the ridge to the west but a considerable area across the Passaic River. In discussing the dangerous nature of this area with the Hudson County Mosquito Extermination Commission, the entomologist was requested to prepare a plan of drainage that would relieve the situation. Mr. Mitchel Carroll, assistant to the entomologist, made a study of the area and prepared the following detailed plan.

The Drainage of the Marshes North of the Harrison Turnpike and Between Frank Creek and the Upland in Hudson County

Mitchel Carroll

North of the Harrison Turnpike, and between Frank Creek and the upland, there are approximately 200 acres of marsh. This region was recently surveyed and mapped.

It is not claimed for the survey that it is complete nor minutely accurate in all its details. On account of the amount of water overlying the surface, the soft nature of the soil, and the height and density of the vegetation, a complete survey of this region would have been rather costly. Furthermore, the necessity for extensive triangulating and levelling was not apparent. The prospective use of the data that might have been gathered in this way was out of all proportion to its probable cost. It is believed that the data obtained in the survey are sufficiently detailed and accurate to demonstrate that it is possible to drain the area in question by means of the 12-inch pump on the east bank of Frank Creek, and to indicate a method of doing this.

The marsh west of Frank Creek and north of the Harrison Turnpike is divided by railroad embankments into four areas. These are designated as Areas 1, 2, 3 and 4.

Area 1

Area 1 lies north of the new Newark and Paterson branch of the Erie Railroad and between Frank Creek and the upland. It is subdivided by the Bergen Avenue and Duke and Tappan Street sewers into three smaller areas, designated Areas 1A, 1B, 1C. It is advisable, in order that their contents may not be spilled over the marsh, and to prevent the blocking of ditches, culverts and pump by sludge deposits, to confine all open sewers within the banks and to establish no connections between drainage ditches and sewers. Hence the drainage system recommended for this area is independent of the sewer system.

It is proposed to leave the sewer system as it is at present except that the banks of all sewers should be repaired and raised sufficiently to prevent the escape of any sewage on the marsh. This arrangement has the advantage of relieving the Hudson County Mosquito Extermination Commission, to whom the responsibility does not rightly belong, of the burden of pumping or otherwise taking care the sewage of the towns on the upland.

Area 1A

Area 1A lies between the Bergen Avenue sewer and Frank Creek. In this area it is recommended that a main drainage canal 4 feet wide and approximately 2,400 feet long be dug. This canal, marked Ditch No. 1, should extend in a *straight* line diagonally across the marsh from a point on the Bergen Avenue sewer about 200 feet northwest of the junction of the Bergen Avenue and Duke Street sewers, to the upland in the vicinity of the dairy. Near the upland end this ditch should be about 30 inches deep. That is, the bottom, in the scale of elevations used, would have an elevation of about 92 feet and would be 4 feet above the bottom of the present sump on the east bank of Frank Creek, or 6.84 feet below the top of the concrete work on the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad. As it approaches the Bergen Avenue sewer there could be a drop of about 1 inch every hundred feet; so that at the Bergen sewer the depth would be about 54 inches. That is, the elevation of the bottom at this point, according to the scale, would be about 90 feet, or 1½ feet above the bottom of the present sump, or 8.84 feet below the top of the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad.

Ditch No. 1 is planned to supply sufficient reservoir capacity to draw all rain water off the adjacent marsh within 24 or 48 hours after precipitation. In this it will be assisted by the ditch which at present parallels Frank Creek. These two ditches should be connected at their ends, near the Erie Railroad. The old ditch would then discharge into the proposed canal, instead of, as at present, into Frank Creek. Laterals 20 by 30 inches or 30 by 30 inches should, of course, be run out as needed from Ditch No. 1.

The cost of digging Ditch No. 1 by hand at 30 cents per linear foot would be about $720.

Sluice Under Bergen Avenue Sewer. To preserve its independence of the Sewer system it is proposed to carry Ditch No. 1 under the Bergen Avenue Sewer in a wooden sluice. This sluice is planned to be 50 feet long by approximately 2 feet square. It could be built of 2-inch by 12-inch by 10-foot rough planks used lengthwise. Half the planks will need to be tongued on one edge; the other half will need to be grooved on one edge. The ribs should be on the outside, placed about 1/3 feet apart and should consist, except at the joints, of 3-inch by 4-inch timber. At the joints, i. e., every 10 feet, the ribbing should consist of 3-inch by 6-inch material.

The above sluice could be constructed of five 10-foot boxes. Each box would consist of eight 2-inch by 12-inch by 10-foot planks; four of the planks would need to be grooved on one edge, the other four tongued on one edge. The tongue and groove is to insure a tight joint between the two planks along the center line of each of the four plain sides. At the junction of the planks along the four angles of the box it is possible to use either a miter joint or a joint such as is used for skirtings, doors, jambs, etc. The latter is a modified tongue-and-groove affair and is the tightest joint that could be used here. It is believed, however, that simple square joints would be the best in the end. If the four sides are joined together so that the interior cross-section is not an oblong, but a square, this type of joint reduces the interior cross-section area the least of any. It is also the cheapest, and because heavier spikes can be used, is probably the strongest; also if it is calked it can certainly be made as tight as necessary. Three feet two inches from either end of the box ribs of 3 by 4-inch timbers should be spiked to the outside. the four corners of the ribs being either miter or square joints, or what is perhaps a better arrangement, the vertical and horizontal ribbing could be laid side by side at the corners and bolted together. At one end of each box, except the two which are to be used for the beginning and end of the sluice, respectively, a rib of 3 by 6-inch timbers should be spiked to the outside. Three inches of this rib should extend beyond the end of the box, for when the sluice is laid the ribless end of the next box is to be inserted and spiked fast. Ribs 3 by 4-inches are large enough for the box ends which are to serve respectively as the inlet and outlet of the sluice.

Across the ribs on top of the sluice it would be well, in order to relieve this pressure on the planking of the box, to spike a double row of 2 by 12-inch planks. These need not be tongued and grooved.

The ends of the sluice should be protected by walls of sheet piling. Each wall should be 6 feet in length and would require six 8-foot rough 2 by 12-inch planks. It should be braced with 3 by 4-inch timber.

The sluice may be set on 3 by 6-inch cross-pieces bolted to 10 or 12-inch round piling. The piling should project above the boxes far enough to allow 3 by 4-inch cross pieces to be bolted across the top. About twelve 10-foot piles would be required.

It would be well to protect the inlet of the sluice with wire grating.

To construct the complete sluice, then, would require the following lumber:

400 ft. of 2″x12″ rough planks (½ grooved on one edge; ½ tongued on one edge)	800 bd. ft.
196 ft. of 2″x12″ rough planks (plain)	392 bd. ft.
171 ft. of 3″x4″ rough timber	171 bd. ft.
67 ft. of 3″x6″ rough timber	100.5 bd. ft.
Total	1,363.5 bd. ft.

12 10-ft long 10″ or 12″ round piling.

The best prices quoted on the above lumber were 10½ cents per foot for yellow pine and 9 cents per foot for Jersey oak. Ten-foot piling, 12 inches thick at the base, can be bought for $1.60 per pile. Allowing 10 cents per foot for the lumber, the cost of the above culvert would be as follows:

1363.5 bd. ft. of lumber at 10 cents	$136.35
12 10-ft. 12″ piles at $1.60	19.20
Labor	60.00
Total	$215.55

Area 1B

It is proposed to drain Area 1B, lying between the Duke Street and Bergen Avenue sewers, by Ditch No. 2. This is a 3-foot wide ditch approximately 1,200 feet long. It runs in a straight line diagonally across the marsh from a point near the upland to a point near the Duke Street sewer about 200 feet above the junction of the latter with the Bergen avenue sewer. Here it connects with Ditch No. 1. It is proposed to carry these two ditches (Nos. 1 and 2) after their junction under the Duke Street sewer, by a wooden culvert similar to the one already described.

At its head near the upland, the bottom of Ditch No. 2 might have an elevation of 92 feet according to the scale, that is, it should be about 4 feet above the bottom of the present sump or 6.84 feet below the top of the concrete on the southwest corner of the Newark and Paterson-Frank Creek Culvert. This would give it a depth of about 30 inches. It might drop 1½ inches in every hundred feet, so that the elevation of the bottom at the point when it dips under the Duke Street sewer would be about 90.5 feet, or 2 feet above the bottom of the present sump and 8.34 feet below the top of the southwest corner of the concrete culvert of the new Newark and Paterson branch of the Erie over Frank Creek. Laterals may be run from this ditch as needed.

The cost of Ditch No. 2 at 25 cents per linear foot would be $300.

To carry ditches 1 and 2 under the Duke and Tappan Street sewer will require a culvert 40 feet long. This may be constructed of wood in the same manner as the sluice under the Bergen Avenue sewer already described. The following lumber will be needed.

320 ft. of rough 2″x12″ planks (½ grooved on one edge and ½ tongued on one edge)	640 bd. ft.
176 ft. of rough 2″x12″ planks (plain)	352 bd. ft.
56 ft. of rough 3″x6″ timber	84 bd. ft.
147 ft. of rough 3″x4″ timber	147 bd. ft.
Total	1,223 bd. ft.
10 round piles 12″x10 ft.	

The approximate cost of this sluice completed would be as follows:

1223 bd. ft. of lumber at 10 cents	$122.30
10 round piles, 12″x10 ft., at $1.60	16.00
Labor, nails, etc.,	55.00
Total	$193.30

It would be well to protect the inlet of this culvert like the one under the Bergen Avenue sewer, by some sort of grating or strainer.

Area 1C

Area 1C is the small section of marsh between the Erie Railroad and the Duke and Tappan Street sewer. It is proposed to run Ditch No. 3 through this area in a straight line parallel to the railroad, from the dump on the upland end to Ditch No. 1. It would form a junction with the latter between the Erie Railroad and the Duke and Tappan Street sewer. Ditch No. 3 would be about 1,100 feet long. It should be about 2 feet wide. At the upland end the elevation of the bottom might be about 92 feet, or 3½ feet above the bottom of the present sump and 6.84 feet below the top of the Southwest corner of Frank Creek culvert of the Erie Railroad. This should give a depth of about 30 inches. At the lower end, near the Bergen sewer culvert, the elevation of the bottom might be 91 feet, 2.5 feet above the bottom of the present sump and 7.84 feet below the top of the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad. This would give a depth of about 42 inches below the level of the marsh.

The cost of Ditch No. 3 at 20 cents per linear foot would be $220.

Beyond its junction with Ditch No. 3 it is proposed to carry ditch No. 1 under the new Newark and Paterson branch of the Erie Railroad by a 30-inch iron pipe. The elevation of the bottom of this culvert should be according to our scale 89.5 feet, one foot above the bottom of the present sump, or 9.3 feet below the top of the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad.

Four 12-foot lengths of pipe would be needed. At 3,500 pounds per length, the total weight of this pipe would be 14,000 pounds, or 7 tons. At $78.25 per ton (price quoted by Crane Company, June 14, 1918) the cost of the pipe would be $547.75. It ought not to cost more than $100 to lay this pipe. This would bring the total cost to $647.75.

South of the new Newark and Paterson Branch of the Erie Railroad. Ditch No. 1 would discharge into Ditch No. 7, yet to be described.

Area 2

Area 2 is the triangular piece of marsh between the old and new Newark and Paterson branches of the Erie Railroad and Frank Creek. It is proposed to drain it by Ditch No. 4. This is a straight ditch running parallel to, and about 75 or 100 feet north of the old Newark and Paterson branch of the Erie Railroad. The ditch, as planned, would be about 1,200 feet long and 3 feet wide. The elevation of the bottom at the upland end could be about 92.5 feet, or 4 feet above the bottom of the present sump, and 6.34 feet below the top of the concrete work on the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad. This should give a depth of about 30 inches. At the lower, or Frank Creek end of the ditch, the elevation of the bottom is 9.34 feet below the top of the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie. This would give a depth at this end of about 60 inches. Ditch No. 4 would thus drop about 3 in 1,200. Laterals should be run out at right angles as needed.

At its lower end, Ditch No. 4 would discharge into Ditch No. 7 to be described presently.

The cost of Ditch No. 4 at 25 cents per linear foot would be $300.

Area 3

It is proposed that Area 3, lying west of the Woburn Degreasing Works and between the Harrison Turnpike and the old

Newark and Paterson branch of the Erie Railroad, be drained by Ditch No. 5. The latter would be approximately 1,000 feet long and 30 inches wide. It is run diagonally across the marsh from a point near the upland to Ditch No. 4. This would necessitate the putting in, by the railroad company or the Hudson County Mosquito Extermination Commission, of a culvert under the old Newark and Paterson branch. The elevation of the bottom of this culvert should be about 91 feet, according to our scale; this would be about 2.5 feet above the bottom of the present sump, or 7.84 feet below the top of the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie. A culvert 24 inches in diameter should be large enough. At the upland end Ditch No. 5 could have an elevation of 92.5 feet at the bottom, 4 feet above the bottom of the present sump, or 6.34 feet below the top of the concrete on the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad. This would probably give a depth of about 30 inches. At the junction with Ditch No. 4 the elevation of the bottom might be 91 feet, 2.5 feet above the bottom of the present sump, or 7.84 feet below the top of the concrete work on the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie Railroad. The depth here would be about 40 inches. Ditch No. 5 would thus drop about 18 inches in 1,000 feet. Laterals are to be run out at right angles as needed.

To dig Ditch No. 5 at 22 cents per foot would cost $220.

The cost of an iron-pipe culvert to carry Ditch No. 5 under the railroad would be as follows:

4 lengths (12 feet each) of 24-inch cast iron pipe at 2450 pounds=9800 pounds, or 4.9 tons.	
4.9 tons of cast iron pipe at $78.25	$383.43
Cost of laying this pipe	50.00
Total	$433.43

Area 4

Area 4 is a small piece of marsh bounded on the east and south by Frank Creek, on the west by the fill of the Woburn Degreasing Company, and on the north by the old Newark and Paterson branch of the Erie Railroad. It could be drained by a ditch 30 inches wide 200 or 300 feet long. This ditch could be dug for about $60. It should pass under the above railroad by a culvert 20 inches in diameter and connect with Ditch No. 7, in Area 2. The culvert under the Erie Railroad should have an elevation at the bottom of 91 feet, 2.5 feet above the bottom of the present sump, or 7.84 feet below the top of the concrete work on the southwest corner of the Frank

Creek culvert of the new Newark and Paterson branch of the Erie Railroad.

This culvert would require three 12-foot lengths of 20-inch cast iron pipe weighing 1,800 pounds per length. This is equivalent to 5,400 pounds, or 2.7 tons. At $78.25 per ton the cost of the pipe would be $211.28. The cost of laying the pipe should not exceed $50. The total cost of the culvert would thus be $261.28.

Ditch No. 7

Ditches No. 1, 4, 5 and 6, as has already been indicated, are planned to discharge into Ditch No. 7. The latter is 10 feet wide by 6 feet deep by 400 feet long, which it is planned to dig from the proposed iron pipe culvert under the new Newark and Paterson branch of the Erie Railroad, to the southeast corner of Area 2. That is, the southeast end of Ditch No. 7 would lie about 50 feet west of Frank Creek and about the same distance north of the old Newark and Paterson branch of the Erie Railroad. This would bring it opposite the sump of the 12-inch pump on the east bank of Frank Creek. The ditch is brought to this point because it is proposed to draw the water from it by means of the pump on the east bank of the Creek in a manner to be hereinafter described.

The elevation of the bottom of this ditch at its lower end, that is, the end opposite the pump on the east bank of the Creek, can be the same as the elevation of the bottom of the present sump. On our scale, the elevation of the bottom at the lower end would thus be 88.53 feet, or 10.31 feet below the top of the concrete work on the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie. The elevation of the bottom of the other end of the ditch should be a foot higher.

The capacity of Ditch No. 7 as planned is about 20,000 cubic feet. or 158,000 gallons. In utilizing the full capacity of the pump, 2,400 gallons per minute, the ditch would be emptied in 66 minutes. It may be that when using the pump to drain this ditch we can not obtain a higher rate than 2,000 gallons per minute. But even at the latter rate, the ditch would be emptied theoretically in 79 minutes. Hence, it is clear that the dimensions of the ditch as given are none too large.

To excavate Ditch No. 7 would require the removal of 889 cubic yards of material. It is thought that this can be done most cheaply by means of dynamite. The cost of the ditch, if the latter explosive used, should not exceed 25 cents per cubic yard. The total cost would thus be about $225.25.

The work of draining the marshes west of Frank Creek should begin with the excavation of Ditch No. 7. It is strongly recommended that dynamite be used as an experiment in this operation. A representative of the Du Pont Powder Company can no doubt be obtained to superintend this work as a demonstration. If the experiment is a success, dynamite can also be used in the larger of the other ditches and the cost of digging the latter would thus be reduced.

The Sump

To draw the water out of Ditch No. 7 by the pump on the east bank of Frank Creek, it will be necessary to construct a sump on the west side of the creek, similar to the present sump on the east side. The east end of the new sump should be about 15 feet west of the creek bank, and should lie just north of the present sump. At its west end the new sump will connect with Ditch No. 7.

The elevation of the bottom of the proposed sump should be the same as the elevation of the deepest part of the present sump. This, on our scale, is 88.53 feet, or 10.31 feet below the top of the concrete work on the southwest corner of the Frank Creek culvert of the new Newark and Paterson branch of the Erie. This would give a depth of six or seven feet.

The sump should be 5 feet wide by 24 feet long. It is recommended that it be lined with 2-inch planks instead of the 1-inch used in the present sump. There should be a gate of 2 layers of 1-inch boards at the west end. For bracing, 3 by 4-inch timbers can be used. The following lumber would thus be required.

424 ft. of 2″x12″ rough planks =	848 bd. ft.
80 ft. of 1″x12″ rough boards =	80 bd. ft.
166 ft. of 3″x4″ rough timber =	166 bd. ft.
Total	1,094 bd. ft.

At 10 cents per board foot this lumber would cost $109.40.

The Overhead Pipe

To draw the water from the above sump it is proposed to carry a 12-inch iron pipe from the north end of the 12-inch T over the present sump, across Frank Creek. The pipe could be carried across the creek on 12-inch round piling. On the west end it would dip down into the sump by means of a 45-degree elbow.

A representative of the Henry R. Worthington Company, manufacturers of the 12-inch pump on the east bank of the creek, was consulted in regard to the feasibility of this plan. The writer was assured it was entirely practicable.

In carrying the pipe across the creek, it will be necessary to have it slope slightly. The plan will not work very well unless this is done. The west end of the pipe, before it starts to dip into the sump, should be about a foot lower than the east end.

Water cannot, of course, be drawn from the two sumps simultaneously. Provision must hence be made for shutting off, or closing, the pipe from one sump when it is desired to draw water from the other. This will necessitate the installing of a gate-valve on each of the two supply pipes. A 90-degree elbow will also be needed on the north end of the 12-inch T mentioned above.

The cost of the pipe, valves, etc., called for in this plan is as follows:

50 ft. of 12″ iron pipe at $4.05 per 100 feet	$202.50
1 90° 12-inch elbow	18.00
1 45° 12-inch elbow	22.50
2 No. 460 Gate-valves at $93.75	187.50
Total	$430.50

Prices quoted by Crane Company, June 14, 1918.

To carry the pipe across the Creek to the proposed sump would also require:

10 12-inch round piles at $1.60		$16.00
16 ft. of 3″x6″ rough timber	24 bd. ft.	
16 ft. of 3″x6″ rough timber	16 bd. ft.	
	40 bd. ft. at 10¢	4.00
Total for lumber		$20.00

The total cost of getting the water from Ditch No. 7 to the pump by this plan, then would be approximately:

Lumber for proposed sump	$109.40
Piles and lumber to carry pipe over creek	20.00
Pipe, valves and elbows	430.50
Labor, spikes, nails, etc.,	120.00
Total	$679.90

The total cost of the drainage plan outlined above for the 200 acres of marsh north of the Harrison Turnpike and between Frank Creek and the upland would be approximately:

Ditch No. 1	$720.00
Wooden sluice under Bergen Avenue Sewer	215.55
Wooden sluice under Duke and Tappen Sewer	193.30
Ditch No. 2	300.00
Ditch No. 3	220.00
Ditch No. 4	300.00
Ditch No. 5	220.00
Ditch No. 6	60.00
Ditch No. 7	225.25
30-inch iron culvert under new Newark & Paterson R. R.	647.75
24-inch iron culvert under old Newark & Paterson R. R.	433.43
20-inch iron culvert under old Newark & Paterson R. D.	261.28
New sump and 12″ iron pipe to pump	679.40
Total	$4,475.96

It is believed this estimate is too high rather than too low, and that it may be possible to do the work as outlined for not more than $4,000.

Conclusion

It should be pointed out that it is useless to put in the proposed sump, and pipe over Frank Creek to connect it with the pump on the east bank, unless an adequate ditching system to feed the sump also is installed. The meadows will remain more or less saturated, and will at times give off broods of mosquitoes unless drained by deep ditches similar to the ones described in this report. The theory back of the broad deep ditches recommended, is that they will act as reservoirs, drawing all water off the marsh within 24 or 48 hours after precipitation, that the meadow will thus be thoroughly dried out and will itself have a considerable reservoir capacity. Rain water does not lie in pools on a dry meadow as on a saturated one, but is quickly absorbed.

Addendum

As supplementary to the foregoing report there are some considerations with respect to the drainage of the area west of Frank Creek that must be referred to.

It is evident to any one who has inspected Frank Creek north of the Harrison Turnpike, especially during or after periods of heavy precipitation, that the creek is at present taking care of all the water it is capable of carrying. This is true at least with the present system of culverts. Of course it is possible to dredge out the creek and put in larger culverts; but that this will be done at any time in the near future is a very remote possibility.

Hence if more water is pumped into Frank Creek under present conditions, there is danger of overloading it, and yet there is no way of getting rid of the water on the marshes which form the subject of this paper except by pumping it into this creek.

Just south of the uptown line of the Pennsylvania Railroad is a stream, discharging into the Hackensack River, designated "Dead Horse Creek." At the present time this creek is connected with the area from which the 12-inch pump on the bank of Frank Creek draws water, by a culvert (which the writer has not seen) along the Belleville Turnpike under the Pennsylvania Railroad tracks and a ditch along the Harrison Turnpike under the same tracks. Parenthetically, it may be noted here, that should it be found desirable, there is plenty of room beside the Belleville Turnpike to substitute an open ditch for the above culvert.

It is thus seen that there is another outlet to Area 3 other than Frank Creek. The writer has inspected this outlet (Dead Horse Creek) and believes, for the reasons given above that it should be more fully utilized than at present. The obvious way to do this is by means of a pump.

It is recommended that a 12-inch centrifugal pump similar to the one on Frank Creek be installed behind the Hackensack River Dike at the outlet of Dead Horse Creek. A power line supplying the Martin Dennis Works already runs to this point. It is fortunate that this is a 2-phase line, and not a single phase line like the one from which the Frank Creek Pump draws power.

The cost of installing a 12-inch low head centrifugal electrically driven pump at this point would be as follows:

1 12″ Class C. Worthington Pump .... (price includes base and pulley)	$410.00
1 2-Phase Western Electric Motor .... (price includes pulley, base and starter)	346.50
2 90° 12-inch elbows	36.00
1 12-inch T	22.50
1 12-inch Crane, No. 460 Gate-Valve	93.75
50 ft. of 12-inch pipe	202.50
	$1,111.25
Pump House sump, concrete work, labor, belt, etc., ...	800.00
Total	$1,911.25

The above estimate is for a pump installed in the same manner as the present one. A better arrangement would be to run a 45-degree 16-inch elbow with 16-inch pipe from the pump directly down into the sump. A 16-inch pipe should be used with a 12-inch pump, as the latter has a 16-inch suction. And a 45-degree elbow is, of course, much more efficient than two 90-degree elbows and 1 T. Although 16-inch pipe is more expensive than 12-inch, this arrangement would not cost much more than one similar to that used on the Frank Creek pump. For the intake, only one 45-degree 16-inch elbow and about 15 feet of 16-inch pipe would be needed.

The present cost of these would be:

15 ft. of 16-inch pipe at $6.03 per foot	$90.45
1 45° 16-inch No. 569 elbow	54.15
Total	$144.60

The cost of an intake similar to the one on the Frank Creek pump would be:

1 12-inch T	$22.50
2 90° 12-inch elbows	36.00
About 20 ft. of 12-inch pipe at $4.05 per foot	81.00
Total	$139.50

The cost of the pipe and valve for the outlet would be about the same in the two plans, as 12-inch pipe could be used here:

The motor listed above is rated at 1,200 revolutions per minute, 60 cycle, 220 volt. It can be delivered in 6 weeks or less from date of order to the Western Electric Company or can be obtained at once from the stock of Venino Brothers and Company, 65 Hamilton Street, Newark. Venino Brothers also have in stock some low-priced 2-phase motors. The pump can be delivered in 8 weeks from date of order to the Henry R. Worthington Company. The pipe can be obtained at once from the stock of Crane Company, Newark.

The entomologist's office recommends to the Hudson County Mosquito Commission that the above pump be installed at the earliest opportunity. It could draw water not only from the eastern side of Area 3, thus relieving the Frank Creek Pump and Frank Creek, but also from Areas 2, 6 and possibly 5 and 7. The culverts, and much of the ditching needed to connect this pump with the above areas already exists.

There is only one possible objection to Dead Horse Creek as an outlet, and that is that it is crossed at the Belleville Turnpike by a water pipe line. As there is usually several feet of water in the creek under this pipe line, the obstruction is slight. Furthermore, with pumping, the water in the Creek would be kept so low that the obstruction would disappear.

It is believed that a 12-inch pump at the outlet of Dead Horse Creek fed by a proper ditch system, and used in conjunction with the pump of Frank Creek, also fed by a proper ditch system, would put an end to mosquito trouble between the New York and Greenwood Lake Branch of the Erie Railroad, and the Harrison Turnpike, and between the Hackensack River and the upland. The theory back of this view is similar to the argument advanced in favor of a pump fed by deep broad ditches for the area west of Frank Creek. By the action of the proposed pump the water in Dead Horse Creek, and the tributary ditches, should be kept very low. The meadow surface would thus dry out thoroughly and rain-water would be rapidly absorbed.

It must be admitted here, however, that there is a difference of opinion among those interested in the drainage of the above areas, as to whether a 12-inch pump has sufficient capacity to take care of the precipitation. But in spite of this the writer does not hesitate to recommend the 12-inch size. For, if after a fair trial it should prove inadequate, another pump can be installed at the same sump. Nothing would be lost and perhaps money can be saved, by thoroughly testing the one recommended before going to greater expense. But care should be taken that the sump is large enough, and that there is room and a place for an additional pump, should one prove necessary.

Note

All prices quoted in this report are those which prevailed on June 14, 1918.

The prices of lumber and piling were quoted by the Cronk Manufacturing Company of New Brunswick, N. J.

The figures on cast-iron pipe for culverts and wrought-iron pipe, elbows, valves, etc., for pumps were obtained from the Newark Branch of Crane Company.

The prices on pumps were quoted by the Henry R. Worthington Company of Harrison.

The figures on electric motors were obtained from the Newark office of the Western Electric Co., and Venino Bros. & Co., of Newark.

The information in regard to the 2-phase power line at the Martin Dennis Works, at the mouth of Dead Horse Creek, was obtained from the Public Service Corporation. If it is decided to install an electrically driven pump at the mouth of this creek, arrangements should be made to have the Jersey City manager of the Public Service Commercial Department formally accept the business before any material is ordered or contracts let.

Raritan Ordnance Depot, Bonhamtown, N. J.

The authorities in charge of the Raritan Ordnance Depot requested a plan for protecting the depot from the mosquito pest. Mr. Mitchel Carroll made the necessary study and prepared the following report.

REPORT ON THE PROBLEM OF PROTECTING THE RARITAN ORDNANCE DEPOT FROM THE MOSQUITO PEST

MITCHEL CARROLL

Introduction

The problem of mosquito control at the Raritan Depot, on account of the species occuring in this vicinity, is a double one. There is first the problem of controlling the species which breed in fresh water, and second, the problem of controlling the salt-marsh species.

The Fresh-Water Problem

The work of protecting the Ordnance Depot employees from fresh-water mosquitoes may be divided into two parts. There is first the prevention of breeding in areas on the reservation and second, the prevention of breeding in areas adjacent to the reservation, or so near that the mosquitoes breeding there may readily migrate to the reservation. The fresh-water work would include the proper draining or filling of all ponds, pools and ditches where possible. Where this is impracticable all stagnant water should be oiled regularly at weekly intervals.

Outside the reservation mosquito invasions are to be expected from species breeding in the ice pond at Bonhamtown. This pond is drained by Mill Brook into the Raritan River about two miles west of the Ordnance Depot. The pond, and the brook throughout much of its course, is within a mile of the reservation. *Anophelines* (the malaria-carrying species) and *Aedes sylvestris,* one of the most troublesome of the fresh-water mosquitoes, breed around the edges of this pond and along Mill Brook. Species of *Anophelines* have been shown to migrate 1 1-4 miles and *sylvestris* 10 miles. Hence the proper protection of the Depot from the fresh-water mosquitoes will require measures to prevent breeding in the ice pond and Mill Brook. The borders of the pond must be cleared of vegetation and the water kept at a sufficient depth to permit fish to get at the wrigglers around the edges. The same measures, cleaning, straightening and deepening the edges, must be taken along the course of Mill Brook wherever breeding is found.

Throughout the season, from May first to October first the reservation and adjacent territory, especially along Mill Brook and the ice pond, should be regularly patrolled and all sluggish water-courses and stagnant poles inspected for larvæ or wrigglers. This inspection will reveal the necessity for further control work (draining, cleaning, filling or oiling) from time to time. It may also show that there is no breeding in some suspected waters, and thus time and expense will be saved. The patrol work should be intrusted to an inspector, who can devote as much time as necessary to it.

The Salt-Marsh Problem

The salt-marsh mosquitoes breed in stagnant pools on the marsh. The control of these species is effected by so trenching the marsh that all stagnant pools are drained by spurs from, or seepage into, the drainage ditches. The drainage system, where there are no dikes and tide-gates, is so arranged that all water on the meadow will rise and fall with the tide and the killifish or salt minnows, with which the tidal creeks are filled, may penetrate to all parts of the marsh and consume the wrigglers (immature forms of the mosquitoes) as fast as they hatch from the eggs. The unit which has been developed for this purpose, through an experience of twelve years of control work by the State Agricultural Experiment Station, is a ditch approximately 10 inches wide and 30 inches deep with perpendicular smooth sides, adequately outletted to tide water. These trenches are arranged in a paralled system with due regard to the use of the creeks, which meander through the meadows, as outlets.

Where there is extensive breeding the salt-marsh mosquitoes migrate on winds of low velocity (10 miles an hour or less) of high humidity (70 per cent or more) and of high temperature (about 80° F.), distances of 30 miles or more.

The following marshes are the only ones within the county that are large enough and near enough to the Raritan Ordnance Depot to be considered dangerous from a mosquito standpoint: Raritan, Carteret, Sewaren, Woodbridge Creek, Sayreville, South River, South Amboy and Cheesequake.

The Carteret meadow is distant about 8 miles to the northeast. It contains 578 acres, and 112,944 linear feet of 10 by 30-inch ditching, or its equivalent, has been installed here by the Middlesex County Mosquito Extermination Commission and the Agricultural Experiment Station. It is estimated that about 37,000 feet of ditching are still required on this meadow.

The Sewaren meadow, containing approximately 447 acres, lies 6 miles to the northeast; 71,422 linear feet of 10 by 30-inch trenching have been cut in this marsh by the commission and the

Experiment Station. Some oil also has been used here, so that no time during the past summer did a heavy brood emerge. But about 88,578 feet of ditching are still needed to complete the drainage of this marsh.

Woodbridge Creek (approximately 711 acres of marsh) is about 5 miles distant to the northeast; 51,721 feet of 10 by 30-inch ditching, or its equivalent, have been cut here by the commission and the Agricultural Experiment Station. Much emergency work, made necessary by the blocking of trenches by hydraulic and garbage fills, was done on this meadow last season. This work (oiling and trenching) prevented severe migrations from this marsh. On this marsh 98,280 feet of trenching still need to be cut.

Even if there has been no control work on the above three marshes, they would hardly be a source of danger to the Ordnance Depot, because the prevailing winds that carry mosquitoes are not from that direction.

One and one-half to two miles to the south is the Sayreville marsh (332 acres) which contains 3000 linear feet of 10 by 30-inch ditching cut by the commission and the Agricultural Experiment Station. Some additional ditching is required to drain this meadow adequately. But in the past this marsh has had only scattered breeding in wet seasons.

The South River marsh (4 miles to the southwest) of 1,929 acres is tide-swept and has caused no trouble in the past.

If breeding should start in the future on the Sayreville and South River marshes, the Du Pont de Nemours Powder Company and the Hercules Powder Company have signified their willingness to cooperate with the commission in controlling it.

The South Amboy marsh, about 5 miles east by southeast, consists of 204 acres; 54,440 linear feet of 10 by 30-inch ditching, or its equivalent, have been cut here by the commission and the Agricultural Experiment Station. No broods escaped from this meadow last summer, but additional ditching (25,560 feet estimated) is needed.

The Cheesequake Meadow (1600 acres) is 7 miles to the southeast; 157,900 linear feet of ditching have been cut here by the commission and the Agricultural Experiment Station. On the southern, or undrained portion of this marsh, extensive breeding occurred last summer during June, July and August. Large migrations took place during the latter two months. But the records of the commission do not indicate that these migrants came to the north side of the Raritan River. Conferences are now being held between representatives of the Gillespie Construction Company, agents of the United States Government, and the Middlesex County Mosquito Commission, to draw up a plan and agreement for the control of breeding on the still unditched portion of this meadow.

On all of these meadows, during the present season, the commission will maintain a patrol and will do as much control work as its funds will permit.

The North Raritan Marsh

It is clear from the above facts that the only salt-marsh mosquitoes likely to trouble employees of the Raritan Ordnance Depot are those which may breed on the Raritan marsh, north of the Raritan River. This marsh consists of 2,235 acres. To control the breeding on it the commission and the Agricultural Experiment Station have cut to date 447,695 linear feet of 10 by 30-inch ditching, or its equivalent. An adequate system of mosquito control on this meadow, it is estimated would necessitate the cutting of 185,628 more linear feet of 10 by 30-inch ditching, or its equivalent, provided the present outlets are not interfered with and provided the discharge of acid on the meadow is prevented.

The Raritan Ordnance Depot property extends from the New Jersey Clay and Brick Company Railroad to about the railroad running to the Nixon Nitration Works wharf. The area contains approximately 1300 acres of the Raritan salt marsh, and 158,136 feet of the trenching referred to in the preceding paragraph. On account of the building operations now going forward and because of lack of funds the commission can no longer undertake to maintain mosquito-control work on this property. If the employees of the Ordnance Depot are to be protected from the salt-marsh mosquitoes bred on the reservation this control work must now be carried on by the Sanitary Department of the Ordnance Depot.

For the purpose of mosquito control the reservation marsh can conveniently be divided into two areas: (1) the areas west of the Bloomfield Railroad and (2) the area east of this railroad.

Salt Marsh West of Bloomfield Railroad

This area consists of 800 or 900 acres of the reservation marsh. On it there are approximately 137,630 linear feet of 10 by 30-inch ditching, or its equivalent, already cut by the commission and the Agricultural Experiment Station to prevent mosquito breeding.

The control work here will consist of cleaning the ditches already installed and maintaining them at their original depth, and the cutting of at least 95,000 more linear feet of 10 by 30-inch ditching, or its equivalent. About 60,000 linear feet of the above ditching should be cut in an undrained area of some 200 acres, near the center of the property, between the Bloomfield Railroad and the Nixon Railroad and south of Red Root Creek. At the northwest corner of the Depot marsh is located the Nixon Nitration Works.

Some 15,000 to 30,000 additional linear feet of 10 by 30-inch ditching will probably be required to bring again under control the mosquito breeding on the 200 acres of meadow adjacent to the Nixon plant and on either side of Red Root Creek east of here.

One of the principles underlying successful salt-marsh mosquito extermination depends upon the presence of killifish to consume the larvæ, or wrigglers, existing in sluggish streams, ponds and ditches. Without the fish these waters become serious mosquito-breeding places. A trace of acid seems to repel killifish, but it requires highly acidulated water to prevent mosquito development.

The meadows on either side of Red Root Creek are naturally low-lying and the acid-charged effluent from the Nixon plant has killed the grass, causing the meadow peat to rot, holes to form and the meadow surface to sink still lower. When the nitration plant was closed temporarily in July of last year the continuous supply of acid was interrupted, and in the sections of the creek where the water was sluggish, the connecting ditches and the sunken meadow areas all began breeding mosquitoes in tremendous numbers; for while there was not enough acid remaining to kill the mosquito wrigglers, a trace of acid persisted and this, apparently, was sufficient to repel the killifish.

The writer understands that the Nixon Nitration Works is now controlled by the United States Government. This should render the repetition of last summer's trouble easy of prevention. It is suggested that the acid effluent be neutralized with milk of lime before it is discharged on the meadow, or that it be carried by flume and ditch directly to the river.

The necessity for cutting new outlets for all ditches blocked by building operations cannot be too strongly emphasized. All ditches containing stagnant water are potential mosquito breeders. The connection of salt marsh trenching with tide water should be maintained. If this is not possible the ditches must be oiled regularly and frequently (at intervals of a week or ten days) or else filled.

Filling can often be substituted to advantage for spurring, in taking care of small depressions on the meadow surface. The sod taken from the ditches can be utilized for this purpose.

In addition to the foregoing measures adequate control of mosquito breeding on the salt marsh requires the maintenance of a patrol and regular inspection of the meadows throughout the season from April fifteenth to October first. This regular inspection of all water on the marsh for larvæ will disclose the necessity for emergency work from time to time. The latter will consist in removing blockages from ditches, shallow spurring to surface pools, and oiling. But if adequate permanent ditching has been installed and is properly maintained, acid pollution and the blocking of ditches by building operations prevented, very little emergency work should be necessary.

In our opinion the best, and in the long run the cheapest, method of controlling mosquito breeding in this section of the Ordnance Depot marsh is to supplement the ditching system by conducting the waters of Red Root Creek under the above railroad through sluices or culverts with tide-gates on the outside. Since the plans for the improvement of the property call for culverts under the railroad anyway, and since the machinery for putting in these culverts is already on the ground and the work has commenced, the additional expense of the tide-gates and sufficient cross-section area of sluiceway to drain adequately the area under discussion would be comparatively small.

Furthermore, since magazines will probably be erected at various places on the marsh, it will eventually be found necessary to build a low dike along the Raritan River side of the marsh to protect the property from the destructive effects of the occasional storm tides. In the latter event tide-gates will be a necessity and it would be much cheaper to put them in now while the culverts are being installed.

So far as mosquito-control work is concerned, however, the above dike is not necessary. All the diking needed is already present in the embankment of the Bloomfield Railroad. All that is required is that tide-gates and culverts of sufficient cross-section area be installed where Red Root Creek passes under the railroad. We have been informed that the plans call for three 3-foot pipes or culverts under the railroad. While these pipes may have capacity enough to take care of the waters of Red Root Creek ordinarily, we believe that during wet weather, or after the occurrence of the occasional extra high tide, the water would not drain off the meadow rapidly enough to prevent mosquito breeding.

Mr. C. C. Vermeule, who investigated the draining of the New Jersey tide marshes for the Geological Survey, recommends that there should be 3 square feet of cross-section area in the sluices for every 100 acres to be drained. In our experience we have found this figure to be about right.

The area of salt marsh drained by Red Root Creek, west of the Bloomfield Railroad and within the reservation, is about 800 or 900 acres. But there are between 300 and 400 acres more of marsh which drain into this part of the creek, so that provisions must be made for the drainage of approximately 1200 acres. (It is not necessary to consider the upland contiguous to the marsh since it is the intention of the Ordnance Depot authorities to drain this by a band ditch into Red Root Creek east of the Bloomfield Railroad.) To drain this 1200 acres satisfactorily would require sluices or culverts with a cross-section area of about 36 square feet. Five 3-foot pipes, properly provided with flappers or tide-gates on the outside (down stream) ends, instead of the three pipes called for in the plans, theoretically should thus be used.

These pipes should be set low enough to drain Red Root Creek to the bottom. If iron pipes are to be used (as we have been informed) bulkheads will not be needed. In this connection it should be pointed out, however, that the acid pollution of Red Root Creek must be stopped or the pipes will suffer from corrosion.

If these five 3-foot pipes and tide-gates are installed and the railroad embankment adjacent thereto rendered tight by suitable filling there should be no further danger of mosquito breeding on the Depot marsh, provided the ditching system is properly maintained. Long continued wet weather and the occasional extra high tide which would flood the meadow from the Raritan River side would no longer be a source of danger. By the action of the tide-gates the water-table of the meadow would be so lowered, and the meadow surface kept so dry, that a reservoir sufficient to absorb all storm and extra high tide-water would be created.

In installing the tide-gates, however, one of the fundamental principles of salt-marsh mosquito control must not be overlooked. The principle, referred to before, is that any stagnant water in surface pool, creek or ditch is a potential mosquito breeder. Because of the action of the tide-gates some of the ditches will at times run practically dry. Stagnant water breeding mosquitoes will remain in low spots in such ditches. To provide for flushing the latter, and to secure a circulation of water, the ditches now draining into the Raritan River should be connected with Red Root Creek. Indeed it might be well to cut a ditch 30 inches deep by from 20 to 30 inches wide just inside of the west end of the property from the river to Red Root Creek and thus insure a circulation from the head of the creek. This ciculation is already partly provided for by the ditching system west of the Nixon Railroad.

Salt Marsh East of Bloomfield Railroad

The reservation marsh east of the Bloomfield Railroad consists of some 300 or 400 acres. This part of the meadow will not be shut off by sluice and tide-gate from tidal action. The Middlesex County Mosquito Extermination Commission and the State Experiment Station have already cut here (as indicated on the map) approximately 20,506 linear feet of 10 by 30-inch ditching, or its equivalent. The control measures recommended for the western or semi-enclosed part of the reservation marsh apply well on this more open area. The present ditching system must be maintained; and all trenches kept at their original depths and free from blockage. The regular patrol and periodic inspection of the meadow will reveal the necessity, if any exists, for new ditching, shallow spurring to pools of storm water and oiling. It may be pointed out here that there is more danger from storm water on an open meadow than one protected by tide-gates.

The water table of a meadow drained by an open-ditch system is not lowered enough to create a reservoir which will absorb storm water as quickly as it is taken up by the enclosed meadow. Hence, there is need of a careful inspection for wrigglers after wet weather and extra high tides. The waters and any portion of the meadow receiving the effluent from the National Synthetic Works on the eastern side of this marsh should be carefully watched for breeding.

The Raritan Ordnance Depot agreed to carry out the measures recommended above to control mosquito breeding on the 1,200 acres of the North Raritan Salt Marsh within its property, and the Middlesex County Mosquito Extermination Commission undertook to control the breeding of salt-marsh mosquitoes on the approximately 1,000 acres of this marsh outside the reservation. On this latter area the Commission and the State Agricultural Experiment Station have already cut 289,559 linear feet of 10 by 30-inch ditching, or its equivalent.

East Shore of Delaware River from Camden to Penns Grove

The plan for protecting the International Shipbuilding Corporation plant at Hog Island and the Westinghouse plant at Essington required a knowledge of the mosquito-breeding conditions on the New Jersey side of the Delaware River. Accordingly, an investigation was made by Mr. Mitchel Carroll, and the results are set forth by him in the following report:

REPORT OF MOSQUITO CONDITIONS ON THE EAST SIDE OF THE DELAWARE RIVER FROM COOPER RIVER TO PENN'S GROVE

MITCHEL CARROLL

Within this district are located the following plants concerned in the manufacture of ships or munitions of war: New York Shipbuilding Company, Pennsylvania Shipbuilding Company, New Jersey Shipbuilding Company, Vacuum Oil Company, Gibbstown Plant of the du Pont de Nemours Powder Company; and, at the southern end, the Carney's Point Plant of the du Pont Powder Company.

The names of streams, towns, etc., as given in this report, are those used on the maps of the United States Geological Survey.

The area covered by this inspection is some 29 miles in length by from 3 to 6 miles wide. It contains, according to planimeter measurements of the United States Geological Survey map, approximately 9,500 acres of swamp or marsh. Some 1,800 acres of this marsh consists of flats overflowed freely by every high tide, and this area is consequently probably free from breeding. Another 3,000 acres is more or less subject to tidal overflow but contains so much tussock, alder, and cat-tail swamp, especially along the smaller streams, that much breeding undoubtedly takes place. Of the remainder, possibly 800 acres is cedar swamp and hence need not be considered. About 4,400 acres of tussock, cat-tail, and alder swamp is free from tidal action, and seems like ideal breeding grounds for *sylvestris* and *perturbans.*

In addition to the above areas there are many acres where extensive breeding undoubtedly occurs, but which are not indicated in the Geological Survey maps. Throughout this region are patches of woodland containing small swamps and pools. These can probably be neglected, as the woodland species which breed there are not known to migrate far. More serious conditions are found in many places behind the 20 miles of dike along the Delaware and the 30 or 40 miles of dike along the creeks tributary to that river. There must be about 5,000 acres of land behind the dikes along Woodbury, Mantua, Raccoon, Repaupo, Oldman's Creeks, and the Delaware River, where the old drainage systems need repairing and extension. This would involve the putting in of a number of new sluices and tide-gates, and perhaps also the installation of pumping stations at several places. But these matters could be determined only by means of careful surveys.

There is probably in the region under discussion a grand total of at least 12,000 acres to be drained in order to control mosquito breeding.

The residents throughout the area under discussion report mosquitoes very troublesome in the early evenings and at night. Except in the marshes themselves they are not troubled by mosquitoes during the day unless the weather is damp and cloudy. In the latter case, especially if the wind is from the direction of large swamps, mosquitoes are reported often present in large numbers at some places, even during the day. In South Camden, in the vicinity of the New York Shipbuilding Company's plant, and in Gloucester, *Culex pipiens* Linn. and *Aedes sylvestris Theob.* appear to be the dominant species. From Gloucester to Penns Grove *sylvestris* seems to be the prevailing species. Residents everywhere in this district describe the common mosquito as a small species with white spots on its back. At intervals most places in this region are subject also to invasions from a large brown mosquito. The latter is usually described as a fierce biter leaving a much larger swelling about the wound than the smaller species. It is possible that this large mosquito may be in some cases *Mansonia pertubans* Wlk., and in others *Aedes subcantans* Felt. And in the southern part of the region under discussion *Aedes sollicitans* Wlk. and *Aedes cantator* Coq. may occur as migrants from marshes down the bay.

It does not seem probable that any salt-marsh species breed in the above area, as the salinity of the river water at Chester Island (in March) was only about 3 per cent. Nor could any reliable reports of the presence of *Anophelines* be obtained. At the Gibbstown plant of the du Pont Powder Company four or five cases of malaria appeared last summer, but only two of these showed the parasite in the blood and all had come from the tropics. Leslie (Report of former Camden County Mosquito Commission), however, reports *Anophelines* breeding in marshes along Cooper Creek.

Psorophora ciliata Fabr. occurs at several places along the Delaware. The mosquito described by employees of New Jersey Shipbuilding Company at the mouth of Big Timber Creek, and by a fisherman at the mouth of Mantua Creek, was evidently this species.

Camden County

In Camden County, within 5 miles of the Delaware River and the plants of the New York, Pennsylvania, and New Jersey Shipbuilding Corporations, there are approximately 2,000 acres of fresh-water marsh along Cooper, Newton, Little Timber, and Big Timber Creeks.

Probably no breeding occurs on 150 or 200 acres of the Cooper Creek marshes, because of the fact that they are overflowed by the tide. Much of the remainder is somewhat subject to tidal action, but in these places breeding undoubtedly occurs in pockets, and in the tussock and elder swamps around the edges of the marshes. There are at least 275 acres of marsh along this creek which would have to be drained or otherwise treated to stop breeding. If it is decided to draw up a plan of mosquito control only to protect the shipbuilding industries along the Delaware, the Cooper Creek marshes might be neglected for the present, as it is not likely that mosquitoes breeding there would migrate past the denser populations of suburban Camden to reach that in the vicinity of the shipbuilding plants.

The 30 acres of marsh along Newton Creek and its branches, however, can not be neglected. For a distance of one mile back from the river the main part of this marsh is overflowed at high tide and would need no treatment. But even in this area, there are many pockets of cat-tail and much stagnant water enclosed by road and railroad embankments which need attention. Here old ditches would have to be cleaned and extended and new ones dug. There a number of old sluices and tide-gates which would have to be repaired and it would probably be found necessary to install some new culverts, sluices and tide-gates.

One and three-quarter miles back from the river the Main Branch and Peter Creek have been dammed by the Woodlynne-

Mount Ephraim road and now form two long ponds. The borders of these ponds would require constant inspection during the breeding season and their banks would have to be kept clean. There is a rise and fall of the tide for 1¾ miles up the North Branch but the areas of tussock, alder and cat-tail swamps along it would require constant inspection and treatment. Much of it could possibly be drained by ditching. Similar conditions prevail for 2½ miles along the South Branch.

There are thus possibly 350 acres of the Newton Creek marshes requiring drainage or other treatment.

In addition to the Newton Creek marshes there are a number of breeding places on vacant city lots within a few city blocks of the New York Shipbuilding Company's plant in South Camden. These consist of pools of stagnant water and small patches of cat-tail.

In the City of Gloucester, within two city squares of the Pennsylvania Shipbuilding Company, is an old cat-tail swamp occupying nearly a square. This is below the level of, and enclosed by, paved streets. Near here there are several other smaller bodies of stagnant water and cat-tail in similar locations. To control the breeding, these would have to be treated by frequent oiling, or else filled or drained. Possibly these areas could be drained into sewers if there are any of the latter nearby. On the eastern side of Gloucester, within ¾ mile of the New Jersey and Pennsylvania Shipbuilding Companys' plants, are some old gravel or sand pits, about three city squares in extent. These contain much stagnant water, algæ and some cat-tail. Periodic oiling would seem to be the only remedy here, as the pits lie too low to drain.

In addition to the above areas there are many smaller breeding places in and around Gloucester, such as road ditches, excavations for cellars over which houses have not been built, receptacles in factory yards, ash-dumps, sewer catch-basins, etc., which would require frequent inspection and treatment. It may be said, indeed, that, if Newton and Timber Creek marshes did not exist, there are probably enough breeding places suitable for *pipiens* and *sylvestris,* in and around Gloucester to make the evenings uncomfortable for the residents of that city and the employees of the shipbuilding companies. Leslie, indeed, in his 1914 report (Camden County Commission) reports very little breeding in the tidal swamps of Newton Creek and says there are sufficient breeding in the ash dumps along Sixth Street to account for much of the Gloucester mosquito trouble.

Along Little Timber Creek there are 190 acres of fresh marsh. Behind the dikes, near the junction with Big Timber Creek, are two small cat-tail swamps. One of these is drained, apparently insufficiently, by a sluice and tide-gate into Little Timber; the other does not seem to have an outlet. Both are on property owned or controlled, I believe, by the New Jersey Shipbuilding

Company. A large part of the Little Timber marsh is probably kept fairly free from breeding by tidal overflow, as there is a rise and fall of the tide for at least 2½ miles up this Creek. But around the borders of the marsh, which in many places are wooded, the tussock and alder swamps would have to be frequently inspected during the season. And no doubt much drainage work would have to be done.

On Big Timber Creek and its tributaries there are 745 areas of marsh, half of it in Camden County and half in Gloucester County. For five miles up from the junction of this creek with the Delaware there is tidal action. Yet it is possible that breeding occurs more or less over some 400 or 500 acres of this marsh. For the most part it consists of open tussock swamp with adlers around the borders, and woodland swamps along the smaller tributaries. Most of this would have to be drained without the use of tide-gates, as the latter would interfere with navigation. This makes drainage in some places a difficult problem on account of lack of grade. Behind the dikes near the mouth the ditches would also have to be watched for breeding and perhaps some additional drainage put it.

The Big and Little Timber Creek marshes, then, in need of treatment to stop mosquito breeding amount to about 500 acres.

In Camden County, in a single strip of territory 5 miles wide extending along the Delaware River from Cooper Creek to Big Timber Creek, inclusive, there are thus about 1,000 acres of fresh-water marsh requiring drainage or other treatment in order to control mosquito breeding. The marsh is of such a character that machines like the Eaton ditcher could hardly be used. Ditching would have to be done by hand. In addition to these large marshes there are the smaller breeding places in South Camden and Gloucester mentioned above.

Some of the latter could be eliminated; others would require frequent periodic inspection and oiling.

Gloucester County

Gloucester County extends along the Delaware River from Big Timber Creek to Oldman's Creek, a distance of 19 miles. Including only the territory extending back 4½ miles from the river, there are in this region, according to the United States Geological Survey maps, along Big Timber, Woodbury, Mantua, Clonmell, Nehonsey, Repaupo, Little Timber (not the Little Timber Creek of Camden County), Raccoon and Oldman's Creeks, and the Delaware River, some 8,169 acres of marsh. In addition to this there are in the neighborhood of 3,000 to 4,000 acres of other low-lying land behind river and creek dikes, which lack adequate drainage from a mosquito control standpoint.

The Big Timber Creek Marsh has already been considered.

On the southwest of Westville there is an unnamed brook which runs through about 70 acres of marsh. Part of this is woodland and tusssock and is no doubt infested with *sylvestris* and the less important woodland species. One-third or one-half is flushed by the tide and therefore can be neglected; the remainder would require drainage or oiling.

The United States Government owns or has leased, I believe, all the land (about 1,800 acres) along the Delaware from Westville to Red Bank. The western part of this strip lies directly opposite League Island. Just west of Westville there two or three small cat-tail potholes which could be drained by short ditches into the river. The greater part of this property, known as the Campbell Farm, lies between the lighthouses and Red Bank. On the Geological Survey map there are indicated 95 acres of marsh on the eastern end of the Campbell Farm. This marsh has been filled and no longer exists. West of this filled-in marsh there are about 500 acres of drained land. The system of ditches discharged into a large (15 or 20-ft.) main drainage canal. The latter discharges through sluice and tide-gate into the river. There is provision for flooding both the land and part of the canal. The above ditches should be carefully inspected for larvæ as the water in some is apparently stagnant. Besides cleaning these ditches and perhaps altering the grades of some, there are a number of cat-tail swamps on this farm still in need of drainage. It would be difficult to say, without making surveys, how much ditching is needed here to eliminate breeding. But probably not over 160 acres are still in need of drainage.

There is a marshy stream with some over-hanging privies on the eastern side of Red Bank, in part of which breeding undoubtedly occurs. There is also a small swamp behind the boat-houses on the beach toward the western end of Red Bank.

About ½ mile south of the Battle Monument at Red Bank there is an open field marsh of perhaps 20 acres. This would have to be drained into the low-lying land behind the dikes along Woodbury Creek.

Woodbury Creek joins the Delaware opposite Hog Island. The land behind the dikes on either side of this creek, and extending back 1½ miles from the river, is badly in need of an adequate drainage system. There must be 500 acres of this low-lying land, much of it near the mouth of the creek being marsh. Everywhere there are old drainage ditches, but for many of these no outlet could be found, and in most the water appeared stagnant. Many of the ditches in the marshier area near the river were more or less choked with algæ. Without taking levels it would be impossible to say whether this area could be drained without pumping. Some of it seems to be below tide-water.

Further up the creek some 488 acres of marsh are indicated on the geographical map. About 200 acres of this are behind the dike and similar to the area referred to in the preceding paragraph. The remaining 288 acres are tussock and alder swamp; 140 acres are along a tributary which discharges by sluice and tide-gate into the main stream. Inspections for larvæ might reveal the need of ditching. The other 140 acres are more or less subject to tidal action but are along small tributaries in part wooded. They should be inspected for breeding, if it is desired to protect the people of Woodbury. The war industries on the river would scarcely be troubled by mosquitoes from here.

Between Woodbury and Mantua Creeks are two small streams which discharge under the Delaware dike by sluices and tide-gates. With their systems of ditches they drain the land through which they flow, but there are 10 or 20 acres of open tussock swamps here which need inspection and probably further drainage.

Conditions along Mantua Creek, which also lies opposite Hog Island, are very similar to those just described for Woodbury Creek. As in the case of the latter stream, the land contiguous to this creek for some distance (2½ miles) back from the river appears dry on the Geological Survey maps. But in fact, there is much stagnant water in old drainage ditches and considerable marshes behind the dike. At the mouth, on the right bank, mud dredged from Hog Island Channel is being used to fill a low-lying area. On the left bank there are some cat-tail swamps adjoining the fertilizer plant there. From here to Berekley (2½ miles from the mouth) there must be 600 acres behind the dikes more or less in need of drainage to stop mosquito breeding. Just how much ditching and how many new sluices and tide-gates it would be necessary to put in could be determined only after a careful inspection of the ditches and swamps for larvæ and the taking of levels. In the neighborhood of Berekley and Mount Royal (3 or 3½ miles from the river) there are some 160 acres of marsh indicated on the map. Part of this is behind the dikes and part is subject to flushing by the tide. There are, then, on Mantua Creek, about 680 acres of marsh of low-lying land which need careful inspection for breeding and on which, where breeding is found, surveys would have to be made to locate drainage ditches and tide-gates.

The marsh through which Clonmell Creek flows is about 130 acres in extent. It is an open field swamp, and, while seen only from the train, did not appear difficult to drain by ditching.

In the vicinity of Gibbstown (5 miles distant from Hog Island and 10 from Gloucester) occurs the largest single area of marsh in either Camden or Gloucester counties. It is likewise the one where the most extensive breeding probably occurs and will be the most difficult to drain. There can scarcely be less than 2,000 acres of swamp here. The marshy area is larger than appears on the map, for there is much swamp in the Thomson Point neighborhood which is dry according to the Geological Survey sheet.

This Gibbstown swamp consists for the most part of open tussock and cat-tail. It is traversed or drained by Repaupo Creek, the Sand Ditch, Pargey, London, Still and Nehonsey brooks and numerous ditches. This drainage system discharges eventually by sluices and tide-gates under the Delaware River dikes. Most of this area lies very low and to drain it sufficiently to stop mosquito breeding would doubtless require pumping. Mr. Thomas, chief of safety and sanitation for the Gibbstown plant of the du Pont Powder Company, who went over with the writer the part of this area (about 1,500 acres) belonging to the latter company, is authority for the statement that it is impossible to drain the Thomson Point property by gravity.

The 140 acres of marshy foreshore outside the dike east of Thomson Point, indicated on the map, is nearly all flushed by the tide. Breeding could occur only in pockets among some timber at one or two places.

Chester and Monds Islands lie in the Delaware between Chester, Pennsylvania and the Thomson Point or Gibbstown property of the du Pont de Nemours Powder Company in Gloucester County. They are about 4½ miles distant from Hog Island. Each island is a huge cat-tail swamp. On Chester Island there are 340 acres of this character, and on Monds Island 280 acres. About one-third of Monds Island and one-fourth of Chester Island were formerly enclosed by banks and drained. The old dikes, however, have disintegrated to such an extent that in some places they can no longer be traced. The area behind the lines of the old dikes is now no different from the land outside. The old drainage ditches, too, have largely or wholly disappeared. The surface soil on these islands is a soft brown muck, consisting chiefly of organic matter. This is nearly everywhere well saturated with water and in moving about over it one sinks in to a depth of from 3 to 5 inches. Much of the surface, perhaps one-fifth, is overflowed by the average flood tide. The remainder lies a few inches too high to be reached by the daily flood tides, but, according to local fishermen and muskrat hunters, is generally pretty well covered by extra high storm tides. It is this area above the reach of ordinary tides that is dangerous from a mosquito-control viewpoint. There is evidently water standing about the bases of the cat-tails over much of this area for long periods at a time, and according to residents of the neighborhood mosquitoes breed here in countless numbers. The remedy would seem to be ditching. All the lower-lying parts could be opened to the action of the tide and the higher land drained. This ditching, on account of the soft nature of the ground, would be more expensive to install and maintain than the typical salt-marsh drainage. But the basis for a drainage system is present in the form of natural water-ways which penetrate the island at various places.

More than half of the 1,260 acres of marsh indicated on Little Timber Creek (do not confuse with the Little Timber Creek of Camden County) consist of woodland; and much of the latter is cedar swamp. But around the borders of the cedar swamp, and continuous with it, are areas of open tussock and cat-tail, with some alder and maple swamp. In the opinion of the writer, it would be an exceedingly expensive proposition to attempt to drain the Little Timber swamp. It is an engineering problem of some magnitude and the cost could be estimated only after a careful survey.

Southwest of the Little Timber marsh is an open field swamp of 124 acres, which was seen only from a distance, but appeared partly drained.

Most of the 400 acres of marsh indicated in the vicinity of Raccoon Island are not dangerous from a mosquito standpoint. Much of the foreshore marsh is flushed by the tide and the part of it lying behind the island has been drained. The problem here is chiefly one of ditch inspection and putting in some additional spur ditches.

As is the case along all the Gloucester County creeks, there are ditches and small marshes behind the dikes at various places along Raccoon Creek which need attention from the mosquito exterminator. Across the creek from Bridgeport there are 180 acres of tussock and cat-tail which lack adequate drainage. More or less continuous with this are about 95 acres of maple and alder swamp.

Between the last mentioned marsh and Oldman's Creek are 260 acres more of mixed open field, maple and alder swamp.

The dikes on Oldman's Creek, the southwestern boundary of Gloucester County, were found broken in many places. Consequently, much of the low-lying land on the left bank from the river to Pedricktown was flooded. The 300-acre marsh on the right bank at Pedricktown also was flooded. The road which crosses the creek at this point was under a foot or two of water, as was also the road which crosses the creek near the river.

Besides the marsh already described the low-lying land behind the 15 or 18 miles of the Delaware River dike in Gloucester County needs frequent inspection for breeding during the mosquito season. This land is traversed by numerous drainage ditches, in many of which the water is stagnant. At a few places, as within a mile of Oldman's Creek, land once drained has again grown up with cat-tail on account of breaks in the dike or through other causes. At many places it may be found necessary to repair dikes or put in additional ditches, sluices and tide-gates.

Thus in Gloucester County a mosquito-extermination campaign would involve the drainage of approximately 10,700 acres of marsh or low-lying land. It would require the repairing of dikes, old sluices and tide-gates, and the putting in of a number of new tide-gates. At least in two places, Woodbury Creek and the Gibbstown marsh, pumping systems might have to be installed.

Salem County

The northern corner of Salem County was traversed as far as Penns Grove. There is very little marsh here.

Tabular Estimate of Areas in Camden and Gloucester Counties, Within 6 Miles of the Delaware River, Between Cooper Creek and Oldman's Creek, Requiring Drainage in Order to Control Mosquito Breeding

Camden County

Location	Character	Acres
Cooper Creek	Tussock and alder swamp	275
Newton Creek	Tussock, alder and cat-tail swamp ...	350
Little Timber Creek ..	Tussock, alder and woodland swamp ..	90
Big Timber Creek ...	Tussock and alder swamp	200
Isolated small swamps	. . ..	100

Total for Camden County .... 1,015 acres

Gloucester County

Location	Character	Acres
Big Timber Creek	Tussock, alder and woodland swamp	250
Campbell Farm, east of Red Bank	Cat-tail swamp	150
Red Bank	Tussock, alder and woodland swamp	75
Woodbury Creek	Low-lying land behind dikes, tussock and tussock and alder swamp	670
Mantua Creek	Low-lying land behind dikes, cat-tai alder swamp	680
Clonmell Creek	Open field (some tussock swamp)	130
Gibbstown	Open tussock and cat-tail	2,000
Monds Island	Cat-tail swamp	280
Chester Island	Cat-tail swamp	340
Little Timber Creek	Cedar, maple, tussock and cat-tail swamp (more or less continuous)	1,260
Southwest of Little Timber Marsh	Open field	124
Bridgeport and Raccoon Creek	Maple, tussock, alder and cat-tail swamp	300
Oldman's Creek	Partly tussock flooded at present by breaks in dike	500
Behind Delaware River dikes and isolated small swamps	Wet meadow, stagnant water in old ditches. Some cat-tail and tussock swamp	4,000

Total for Gloucester County .... 10,759 acres

Grand Total .... 11,774 acres

Atlantic Loading Company and Bethlehem Steel Company Testing Plants at Ellwood and May's Landing

At the request of Mr. E. C. Whitcomb and Mr. A. J. Kingsbury, of the Atlantic Loading Co., at Ellwood, N. J., and Mr. William H. Ennis of the Bethlehem Steel Co., of May's Landing, plans for protecting these concerns were prepared by Mr. Mitchel Carroll, assistant to the entomologist, and Mr. Fred A. Reiley, chief inspector of the Atlantic County Mosquito Extermination Commission. The plan follows.

Plans, Specifications and Estimates for Relieving the Ellwood, N. J. Plant of the Atlantic Loading Co. and the May's Landing, N. J., Plant of the Bethlehem Steel Co.

Mitchel Carroll
and
Fred A. Reiley

These plans, specifications and estimates have been prepared after carefully considering the sources from which the mosquitoes troubling these plants come. Without doubt, not much less than 99 per cent. of the specimens giving trouble at these points are mosquitoes which breed on the salt marshes and fly, or are wind-carried, to the areas where these plants are located.

By reference to the map it will be seen that the salt marshes within a distance of thirty miles of these points lie to the southwest, south and southeast, east and slightly northeast. In view of the fact that the species of salt-marsh mosquitoes concerned only rarely exceed thirty miles in the course of migration, it is obvious that such specimens as reach these plants must come from the directions specified.

Careful study of the problem has served to show that the species of salt-marsh mosquitoes concerned travel on winds of low velocity (10 miles an hour or less), of high humidity (70 per cent. or more), and of high temperature (about 80 degrees F.).

Examination of wind direction and speed for the months of May, June, July, August and September in the years 1914, 1915, 1916 and 1917, will serve to show that the prevailing winds during the months mentioned, especially during July and August, come from the south and southwest. They will also serve to show that the winds from the east and from the northeast, especially, are relatively rare, with the exception of during the year 1916, when all but one emergence was followed by easterly winds (these flights covered Egg Harbor, Ellwood, Hammonton, a very few reaching May's Landing). They further serve to show that favorable wind velocities occur during the latter part of June, July, August and the forepart of September. It may be assumed safely that winds from the south, southeast, east and northeast, by reason of the fact that they come off large bodies of water, are heavily charged with moisture. It may also be safely assumed that winds from the southwest, when they leave Delaware Bay, are heavily charged with moisture. During the latter half of June, July, August and the forepart of September, the temperature is normally high enough to favor mosquito flights.

It thus appears that from the standpoint of wind direction, wind speed, humidity and temperature, salt-marsh mosquito flights may readily take place during the latter part of June, July, August and the forepart of September from the salt marshes before mentioned to the regions in which these plants are located. It therefore seems necessary, in outlining a plan for the protection of these plants, to include the completion of the drainage of the marshes which lie to the northeast, east, southeast, south and southwest.

Inasmuch as this involves a tremendous area of marsh and contemplates a large expenditure of money it has been deemed wise to present three different plans of procedure: *first,* a plan which contemplates the completion of the drainage of the salt marshes included in the Mullica River, Great Egg Harbor River and Tuckahoe River valleys and likely to result in comparative freedom from the pest; *second,* a plan which contemplates the completion of the drainage of all salt marshes lying within a radius of twenty miles of these plants and promises practical freedom from the pest; *third,* a plan which contemplates the completion of the drainage of all salt marshes which lie within a radius of thirty miles of these plants and promises absolute freedom from this pest insofar as such a thing may be had.

Detailed specifications are given under each of these plans, which will now follow in this report in regular order.

Table I

Plan for Comparative Freedom Involving the Completion of Drainage of the Salt-Marsh Basins of Mullica, Great Egg Harbor and Tuckahoe Rivers

COUNTY	Area No.	Acreage		No. of feet of 10x30 inch ditching, or its equivalent, required.	Cost to complete drainage in 150 days		Cost to complete drainage in one year	
		Total	Amount to be drained		Cutting ditches at 2¼ cents per foot	Overhead at 16¼ cents per acre	Cutting ditches at 2 cents per foot	Overhead at 16½ cents per acre
Atlantic	1	7,375	7,375	2,360,000	$53,100.00	$1,216.87	$47,200.00	$1,216.87
	3	10,893	5,165	1,652,800	37,188.00	852.22	33,056.00	852.22
Burlington ..	4	9,717	9,717	3,109,440	69,962.40	1,603.30	62,188.80	1,603.30
Ocean	5	4,020	1,712	547,840	12,326.40	282.48	10,956.80	282.48
Cape May ...	7	5,364	4,377	1,400,640	31,514.40	722.20	28,012.80	722.20
Totals		37,369	28,346	9,070,720	$204,091.20	$4,677.07	$181,414.40	$4,677.07

Cost of completing above drainage in 100 days.

Cutting ditches	$204,091.20
Overhead	4,677.07
Total	$208,768.27

Cost of completing above drainage in one year.

Cutting ditches	$181,414.40
Overhead	4,677.07
Total	$186,091.47

Table 2

Plan for Practical Freedom Involving the Completion of Drainage of All Salt Marshes Within 20-mile Radius of Plants

COUNTY	rea No.	Acreage		No. of feet of 10x30 inch ditching, or its equivalent, required.	Cost to complete drainage in 150 days		Cost to complete drainage in one year	
		Total	Amount to be drained		Cutting ditches at 2¼ cents per foot	Overhead at 16½ per acre	Cutting ditches at 2 cents per foot	Overhead at 16¼ cents per acre
Atlantic	1	7,375	7,375	2,360,000	$53,100.00	$1,216.87	$47,200.00	$1,216.87
	2	31,720	856	273,920	6,163.20	141.24	5,478.40	141.24
	3	10,893	5,165	1,652,800	37,188.00	852.22	33,056.00	852.22
Burlington ..	4	9,717	9,717	3,109,440	69,962.40	1,603.30	62,188.80	1,603.30
Ocean	6	4,020	1,712	547,840	12,326.40	282.48	10,956.80	282.48
Cape May ..	7	5,364	4,377	1,400,640	31,514.40	722.20	28,012.80	722.20
	8	2,375	....	....	....	....	....	....
	9	8,179	6,543	2,093,760	47,109.60	1,079.59	41,876.20	1,079.59
Totals		79,643	35,745	11,438,400	$257,364.00	$5,897.90	$228,769.00	$5,897.90

Cost of completing above drainage in 150 days.

Cutting ditches	$257,364.00
Overhead	5,897.90
Total	$263,261.90

Cost of completing above drainage in one year.

Cutting ditches	$228,768.00
Overhead	5,897.90
Total	$234,665.90

Table 3

Plan for Absolute Freedom (as Nearly as Such a Thing Can Be Had) Involving the Completion of Drainage of All Salt-Marsh Areas Within a 30-mile Radius of Plants.

COUNTY	Area No.	Acreage		No. of feet of 10x30-inch ditching, or its equivalent required	Cost to complete drainage in 2 years	
		Total	Amount to be drained		Cutting ditches at 2¼ cents per foot	Overhead at 16½ cents per acre
Atlantic	1	7,375	7,375	2,360,000	$53,100.00	....
	2	31,720	856	273,920	6,163.20	....
	3	10,893	5,165	1,652,800	37,188.00	....
Burlington	4	9,717	9,717	3,109,440	69,962.40	....
Ocean	5	4,020	1,712	547.840	12,326.40	....
	6	24,403	13,922	4,455,040	100,238.40	....
Cape May	7	5,364	4,377	1,400,640	31,514.40	....
	8	2,375	....	....	....	....
	9	8,179	6,543	2,093,760	47,109.60..	....
	10	7,077	5,661	1,811,520	40,759.20	....
	11	14,579	11,663	3,732,160	83,973.60	....
	12	975	975	312,000	7,020.00	....
	13	925	925	296,000	6,660.00	....
	14	950	950	304,000	6,840.00	....
	15	9,330	9,330	2,985,600	67,176.00	....
Cumberland	16	1,102	1,102	352,640	7,934.40	....
	17	4,379	4,379	1,401,280	31,528.80	....
	18	16,739	13,391	4,285,120	96,415.20	....
	19	1,292	1,292	413,440	9,302.40	....
	20	1,710	1,710	547,200	12,312.00	....
	21	2,242	1,793	573,760	12,909.60	....
	22	4,104	3,283	1,050,560	23,637.60	....
	23	4,503	3,602	1,152,640	25,934.40	....
Totals.....		173,923	109,723	35,111,360	$790,005.60	$18,104.29

Cost of completing the above drainage in 2 years.

Cutting ditches...........	$790,005.60
Overhead	18,104.29
Total...............	$808,109.89

Location

Area No.		
1	Atlantic County, ...	South side of Mullica River above Leeds Point.
2	Atlantic County, ...	Great Bay to Great Egg Harbor Bay, Ocean to Mainland.
3	Atlantic County, ...	Both sides of Great Egg Harbor River to north side of Tuckahoe River.
4	Burlington County, ...	North side of Mullica River.

5	Ocean County,	From Ballinger Creek on the west side to 1 mile east of Willis Thoroughfare.
6	Ocean County,	Great Bay east of No. 5 to north end of Stafford Township.
7	Cape May County,	South side of Tuckahoe River.
8	Cape May County,	Peck's Bay to 34th Street Boulevard.
9	Cape May County,	34th Street Boulevard to Ludlam Bay.
10	Cape May County,	Ludlam Bay to Tatham L. S. Station.
11	Cape May County,	Stites Sound to Anglesea.
12	Cape May County,	Fishing Creek Marsh, Delaware Bay
13	Cape May County,	Green Creek.
14	Cape May County,	Dias Creek.
15	Cape May County,	West Creek, Dennis Creek and Goshen Creek, Delaware Bay.
16	Cumberland County,	Mauricetown Marsh.
17	Cumberland County,	West Creek Riggen Ditch.
18	Cumberland County,	Maurice River Neck to Beadon Point.
19	Cumberland County,	Maurice River south of Haleyville.
20	Cumberland County,	Dividing Creek Marsh.
21	Cumberland County,	The Glades.
22	Cumberland County,	Fortesque Neck to Nantuxent Creek.
23	Cumberland County,	Cedar Creek to Nantuxent Creek.

Throughout 90 per cent. of the salt-marsh drainage (acreage basis) which has already been put into the salt meadows of the state and throughout the work comprehended in the preceding plans, runs the idea that the control of the salt-marsh mosquito species may be effected by so trenching the marsh that all water upon it will rise and fall with the tide and that the killifish or salt minnows, with which the creeks of the marshes are filled, may penetrate all parts of the marsh and consume the wrigglers (immature forms of the salt-marsh mosquitoes) as fast as they hatch from the eggs and reach a size sufficient to be detected. The unit which has been developed for this purpose, through an experience of about twelve years, is a ditch approximately 10 inches wide and 30 inches deep with perfectly perpendicular smooth sides, adequately outletted to tidal water. These ditch units are arranged in a parallel system with due regard to the use of the creeks, which meander through the meadows, as outlets. Approximately 14,000,000 feet of this sort of ditching has already been established in the marshes of the state.

Plan No. 1 contemplates the drainage of the salt marshes in the basins of the Mullica, Great Egg Harbor and Tuckahoe rivers, and involves the cutting of 9,070,720 linear feet of ditching 10 inches wide and 30 inches deep, or its equivalent. On a short-time basis (150 days) it is estimated that the actual contract cost would be $204,091.20 and that the overhead charge (laying out and testing) would involve a further expenditure of $4,677.07. On a long-time basis, or a period of one year from the time of starting, we estimate that the cost would be $181414.40 and that the overhead charges would be practically $4,677.07. With this plan carried out the plant located at Ellwood, N. J., would rarely be visited by mosquitoes, but the plant located at May's Landing would, in all probability, have visitations several times during the season. These visitations would, however, be of short duration and greatly reduced in severity.

Plan No. 2 contemplates the completion of the drainage of all salt marshes within a radius of 20 miles of these plants. We estimate that this involves the establishment of 11,438,400 linear feet of ditching 10 inches wide and 30 inches deep, or its equivalent. We estimate that the cutting of these ditches on a short-time basis (150 to 200 days) would involve the expenditure, under present conditions, of $257,364.00 for actual contract work and an overhead charge of $5,897.90. On a long-time basis we estimate that this work would cost $228,738.00, with an overhead charge of $5,897.90. The work comprehended in this plan would give to the plant at Ellwood as nearly complete freedom from mosquitoes as an operation of this kind could possibly do. This means that salt-marsh mosquitoes at Ellwood would be rare indeed. This also means that salt-marsh mosquitoes at May's Landing would occur very infrequently and then only in small numbers.

Plan No. 3 contemplates the completion of all the salt-marsh areas within a radius of 30 miles of these plants and involves the cutting of 35,111,360 linear feet of 10 by 30-inch ditching, or its equivalent, costing on a two-year basis $790,005.60, with an overhead charge of $18,104.29. The freedom given to the Ellwood plant by the carrying out of this plan would probably be no greater than that obtained by carrying out plan No. 2; but the freedom at the May's Landing plant would under this plan be about the same as that obtained at the Ellwood plant under plan No. 2.

We have based our estimates of time on the known performance of special salt-marsh trenching machinery. A single well-conducted machine of this type can average 5,000 feet a day. There are at least ten of these machines on the salt marshes of New Jersey and New York states.

There exist in the state of New Jersey two types of legal organization working for the elimination of the salt-marsh mosquitoes. The first is the State Experiment Station, operating under an act passed in 1906, and the second is the County Mosquito Extermination Commission, operating under an act passed in the year 1912. The first organization is the authorized agency for the expenditure of state funds. The work of one county commission is correlated with that of other county commissions and with that of State Experiment Station by the fact that the Director of the New Jersey Experiment Stations is ex-officio member of every county commission and by the further fact that it is his duty to pass upon plans and moneys according to which and with which the county mosquito extermination commission does its work.

With the completion of the initial drainage, maintenance has been, and in all probability will continue to be, made a charge upon local county funds.

Camden and Gloucester Shipbuilding Plants, Camden and Gloucester City, N. J.

Col. Philip S. Doane, chief of sanitation and health for the Emergency Fleet Corporation of the United States Shipping Board, requested the entomologist for a plan of protecting the New York Shipbuilding Corporation and the Pennsylvania and New Jersey Shipbuilding Corporations of Gloucester City from the mosquito pest. Mr. Mitchel Carroll made the necessary study and prepared the following plan:

Report on a Plan to Protect the Shipbuilding Companies in Camden and Gloucester from the Mosquito Pest

Mitchel Carroll

Location of the Shipbuilding Plants

The New York Shipbuilding Company is located in Camden County on the east bank of the Delaware River and the north and south banks of Newton Creek. The Pennsylvania and New Jersey Shipbuilding Companies are in Camden County on the Delaware River north of Big Timber Creek.

Species of Mosquitoes

In this region the dominant species of mosquitoes are *Culex pipiens* Linn., and *œdes sylvestri* Theob. In considering a plan to protect the above companies, it must be remembered that where there is heavy breeding over extensive areas *Culex pipiens* has been shown to migrate 2½ miles and *œdes sylvestris* 10 miles.

Territory in Which Breeding Must Be Controlled

Any plan to protect the employees of these companies from the mosquito pest must be designed to control the breeding in an area at least 15 square miles in extent. This area should include a strip of territory in Camden and Gloucester counties along the Delaware River, 5 miles long by from 2 to 4 miles wide. The northern boundary should be a line drawn eastward 2 miles from a point on the Delaware River, 1 mile north of the New York Shipbuilding Company's plant. The southern boundary should be a line drawn southeastward 4 miles from Eagle Point on the Delaware River. The western boundary would be the Delaware River, and the eastern an irregular line from north to south drawn so as to include all the dangerous breeding places.

Large Breeding Areas Near the Proposed Protected District

The writer is aware that there are extensive mosquito-breeding areas outside the district in which it is proposed to control breeding, and yet within flight distance of the shipbuilding companies.

To the north and northeast, there are some 478 acres of marsh along Cooper Creek. At least half of this, however, is flushed daily by the tide, and hence is not dangerous from a mosquito standpoint. Moreover the winds on which mosquitoes migrate do not come from this direction, and the insects would have to pass some rather dense population to reach the shipbuilding plants.

On the Pennsylvania side of the Delaware, within 10 miles of Gloucester, there are approximately 9,000 acres of marsh of low-lying land in which mosquitoes breed. The amount of money which is being spent ($200,000), and the measures which are being taken to control breeding in this area during the present season, should eliminate this source of danger.

Southwest of the proposed protected district, and within a 10-mile radius of the shipbuilding companies, are the marshes behind the dikes of Woodbury and Mantua creeks. Along each of these creeks there are approximately 650 acres (making 1,300 acres in all) of low-lying land, tussock, alder or cat-tail swamp, which are capable of breeding mosquitoes. It is possible that migrations from these two sources reach Gloucester at times.. The force of inspectors, which it is proposed to employ, should be able to trace such invasions. If they are found serious, the swamps along these creeks will, of course, have to be treated by oiling or draining.

Mosquito-Breeding Places Within the District Where Breeding Must Be Controlled and Methods of Control

In considering the possible sources of the mosquitoes within the proposed protected district the following facts should be kept in mind: (1) any stagnant water devoid of small fish is a potential mosquito breeder; (2) stream or ditch badly polluted with sewage or acid waste from factories, is a source of danger; fish are very sensitive to acid and will not live in water containing a small per cent. of acid, but mosquito larvæ will; (3) in warm weather the life-cycle of a mosquito, from egg to adult, is often completed in two weeks or less.

The best method of preventing breeding in pools of stagnant water or swamps is draining or filling. If these are not practicable the surface of the water may be covered with a film of kerosene or fuel oil to prevent the larvæ from obtaining air. Mosquito larvæ may also be killed by means of larvicides, such as nitre cake, which are miscible with water. But those have the disadvantage of also killing all other vegetable and animal life in the pool or swamp. Mosquito larvæ can be exterminated in large ponds by cleaning and deepening the edges so that small fish or minnows, which consume the larvæ, can penetrate to all parts of the border. Ornamental ponds can be kept free of larvæ by stocking with minnows and keeping a sufficient depth at the borders.

The district in which breeding must be controlled and which has been outlined above includes, then, all the extensive breeding areas on the New Jersey side of the Delaware River from which mosquitoes would ordinarily reach the shipbuilding plants. These breeding places may be divided into three classes: (1) woodland pools; (2) open swamps; (3) urban breeding places.

Woodland Pools

The woodland pools can be neglected, since the woodland species are not known to migrate.

Open Swamps

The far-flying *sylvestris* breeds in the open swamps. Hence those areas, although expensive propositions, must be treated if the shipbuilding plants in the vicinity of Gloucester are to be protected.

There are approximately 830 acres of marsh along Newton Creek and its branches. For a distance of 1 mile back from the river the main part of this marsh is overflowed at high tide and would need no treatment. But even in this area there are many pockets of cat-tail and much stagnant water enclosed by road and railroad embankments which would need attention. Here old ditches must be cleaned and extended and new ones dug. There are a number of old sluice and tide-gates which would have to be repaired, and it would probably be found necessary to install some new culverts, sluices and tide-gates.

One and three-quarter miles back from the river the Main Branch and Peter Creek have been dammed by the Woodlynne-Mount

Ephraim Road and now form two long ponds. The borders of these ponds require inspection during the breeding season and their banks would have to be kept clean. There is a rise and fall of the tide for 1¾ miles up the North Branch but the areas of tussock, alder and cat-tail swamps along it would require constant inspection and treatment. Much of it could possibly either be drained or opened to the tide by ditching. The upper portion by means of a small dam across the culvert under the Woodlynne-Mount Ephraim Road could easily be made into a pond. But if this is done provision should be made for raising or lowering the water when necessary to destroy breeding around the edges. There is a concrete dam across the culvert where the Main Branch and Peter Creek pass under the road and the water level cannot be changed at will. The conditions which prevail for 2½ miles along the South Branch are similar to those on the North Branch.

About two city blocks east of the New York Shipbuilding Company, a sewer discharges into a small tributary of Newton Creek. The marsh at this point should be watched for breeding.

There are thus possibly 350 acres of the Newton Creek marshes requiring drainage or other treatment.

Along Little Timber Creek there are 190 acres of marsh. Behind the dikes, near the junction with Big Timber Creek, are two small cat-tail swamps. One of these is drained, apparently insufficiently, by a sluice and tide-gate into Little Timber; the other does not seem to have an outlet. Both are on property owned or controlled, I believe, by the New Jersey Shipbuilding Company. A large part of the Little Timber marsh is probably kept fairly free from breeding by tidal overflow, as there is a rise and fall of the tide for at least 2½ miles up this creek. But around the borders of the marsh, which in some places are wooded, the tussock and alder swamps need frequent inspection during the season. No doubt much ditching would have to be done. It is not likely, however, that more than 90 acres of these marshes are dangerous.

In Big Timber Creek and its tributaries there are 745 acres of marsh, half of it in Camden County and half in Gloucester County. For 5 miles up from the junction of this creek with the Delaware there is tidal action. Yet it is possible that breeding occurs more or less over some 400 or 500 acres of these marshes. For the most part they consist of open tussock swamp with alders around the borders, and woodland swamps along the smaller tributaries. Some sections might be made into artificial lakes by means of dams. This could be done very cheaply by utilizing the road embankment about ½ mile below the junction of the North and South Branches, for the marsh above this point. At other points drainage might be possible if tide-gates were permitted. But it is doubtful if either dams or tide-gates would be permitted on account of interference with navigation. Possibly many of the dangerous places could be opened to the tide by ditching. Behind the dike near the mouth the ditches need watching for breeding, and perhaps additional ditches would be found necessary to improve the drainage.

On the southwest of Westville there is an unnamed brook which runs through about 70 acres of marsh. Part of this is woodland and tussock and is no doubt infested with *sylvestris* and the less important woodland species. One-third or one-half is flushed by the tide and therefore can be neglected; the remainder would require ditching or oiling.

The United States Government owns or has leased all the land (about 1,800 acres) along the Delaware from Westville to Red Bank. Just west of Westville there are two or three small cat-tail patches which could be drained by short ditches into the river. The greater part of this property, known as the Campbell Farm, lies between the lighthouse and Red Bank. On the United States Geological Survey map there are indicated 95 acres of marsh on the eastern end of the Campbell Farm. This marsh has been filled and no longer exists. West of this filled-in marsh there are about 500 acres of drained land. The system of ditches discharges into a large (15 or 20 feet) main drainage canal. The latter discharges through sluice and tide-gate into the river. There is provision for flooding both the land and part of the canal. The above ditches should be inspected for larvæ, as the water in some is apparently stagnant and fish are scarce. Some of these ditches require cleaning, and the grades of some perhaps need to be changed. There are, too, a number of cat-tail swamps on this farm still in need of drainage. It would be difficult to say, without making surveys, how much ditching is needed here to eliminate breeding. But probably not over 160 acres are still in need of draining.

There are thus approximately 1075 acres of mosquito-breeding marsh so located as to require treatment to protect the shipbuilding companies. The necessary ditching in the marsh land would be somewhat difficult and expensive on account of the soft character of the soil. Ditching machines such as are used in mosquito control work on the salt marshes of the state could not be used. All trenching must be done by hand.

The dangerous swamp areas discussed above may be tabulated as follows:

Location	Character	Acres
Newton Creek.......	Tussock, alder and cat-tail swamp....	350
Little Timber Creek..	Tussock, alder and woodland swamp..	90
Big Timber Creek....	Tussock and alder swamp	450
Westville	Woodland and tussock swamp.........	35
Campbell Farm.......	Cat-tail swamp.....................	150
Total..		1075

Urban Breeding Places

A large proportion of the mosquitoes found above the shipbuilding plants undoubtedly came from urban breeding places in South Camden and Gloucester.

On vacant city lots within a few squares of the New York Shipbuilding Company's plant there are often to be found pools of stagnant water. In some of these patches of cat-tails occur. These are most excellent breeding places for *pipiens* and *sylvestris* and must be oiled regularly at 10-day intervals during the season; or better, the low spots in which they occur could easily be filled with ashes.

In the city of Gloucester, within two city squares of the Pennsylvania Shipbuilding Company, is an old cat-tail swamp occupying nearly a square. This is below the level of, and enclosed by, paved streets. Near here there are several other smaller bodies of stagnant water and cat-tail in similar locations. To control the breeding, these would have to be treated by frequent oiling, or else filled or drained. Possibly these areas could be drained into sewers, if there are any of the latter nearby. On the eastern side of Gloucester, within ¾ miles of the New Jersey and Pennsylvania companies, are some old gravel or sand pits, about three city squares in extent. These contain much stagnant water, algæ, and some cat-tail. Periodic oiling would seem to be the only remedy here, as the pits lie too low to drain by gravity.

In addition to the above areas there are many smaller breeding places in and around Gloucester and South Camden, such as road ditches, excavations for cellars over which houses have not been built, receptacles in factory yards, ash-dumps, sewer catch-basins, etc., which need frequent inspection and treatment. It may be said, indeed, that, if the large marshes discussed above did not exist, there are probably enough breeding places suitable for *pipiens* and *sylvestris* in and around Gloucester to make the evenings uncomfortable for the residents of that city and the employees of the shipbuilding companies.

The only way to control breeding in this urban region is to inspect all premises at intervals of not more than 2 weeks throughout the season. All sewer catch-basins and bodies of stagnant water which cannot be gotten rid of must be oiled regularly at 10-day or 2-week intervals. Barrels and other receptacles which catch and hold rain-water must, of course, be overturned whenever found.

Organization of a Mosquito-Control Force

To carry out a mosquito-control campaign to protect the shipbuilding companies for the present season, it is recommended that the work be put in charge of a chief inspector. This chief inspector should be authorized to employ 4 sub-inspectors, 2 foremen, and 25 laborers. This is the minimum force with which a mosquito campaign can be inaugurated in this region. It is scarcely necessary to say that the chief inspector, and if possible the assistant inspectors, should be men who have had some previous experience in mosquito work.

It is designed that the mosquito squad should be a mobile one, the inspectors must be able to cover thoroughly within a 10-day period the districts assigned them. They must be ready to trace at once all broods invading the shipyards to their point of origin. The gangs of laborers with their tools and equipment are to be moved from place to place as rapidly as the breeding areas causing trouble are discovered by the inspectors.

Fortunately much of the transportation needed can be purchased cheaply from the electric and steam railroads of the neighborhood. To enable the chief inspector to cover rapidly the whole territory, and for carrying men to isolated spots, it will be necessary, however, and for the transportation of ditching tools, spray pumps, oil, etc., to have one Ford or other auto truck. For the use of the assistant inspectors, four bicycles will be needed.

The chief inspector should, of course, be responsible to some agent of the contributing companies for the proper expenditure of the money alloted. It is suggested that he be required to submit fortnightly reports of work accomplished and money spent, and plans of the work with estimates of cost for the succeeding period.

The assistant inspectors and foremen should be solely responsible to the chief inspector for the proper performance of their duties.

The Cost

An estimate of the cost of this season's work, based upon the cost of similar work in other parts of New Jersey, is given herewith.

Labor

1 Chief inspector for 4 months at $120 per month	$480.00
4 Assistant inspectors at $100 per month each for 4 months	1600.00
2 Foremen at $5.00 per day each for 100 days	1000.00
25 Laborers at $3.50 per day each for 100 days	8750.00

Automobile—		
1 Ford truck	$450.00	
Gasoline and oil	150.00	
Tires	120.00	
Repairs	100.00	
License and insurance	25.00	
Storage	40.00	
		$885.00
4 bicycles at $25.00		100.00
Tools (spades, drags, etc.)		150.00
Boots		165.00
Office expense		100.00
Fuel oil (use only paraffin base oil)		675.00
10 knapsack sprayers at $15.00		150.00
Miscellaneous		945.00
Total		$15,000.00

Conclusion

The above seems to be the only feasible plan to protect the industries mentioned from the mosquito pest during the present season. It should, if an experienced, energetic chief inspector is employed, insure South Camden and Gloucester comparative freedom from the pest. Practical freedom cannot be guaranteed for such a sum. But in the absence of any previous experience in control work, records of breeding, flights and imigrations in this region, it would be difficult to draw up a plan to insure absolute freedom.

The idea back of the present plan is that capable and energetic inspectors will be employed. These will cover the territory outlined and discover where extensive breeding is occurring. Plans will immediately be formulated to stop it, and a force of laborers with the proper equipment moved to the locality in question at once. If, in spite of such measures, there are heavy migrations of mosquitoes into the protected district, it is expected the force of inspectors, by flight studies, will immediately locate the source from which the invasion comes. This source can then be attacked even if outside the district delimited.

Plans for Controlling Mosquitoes at the Plant of the International Shipbuilding Corporation

At the request of Col. Philip S. Doane, chief of sanitation and health for the Emergency Fleet Corporation, the entomologist undertook a study of the problem of protecting the employees of the International Shipbuilding Corporation from the mosquito pest. A careful examination of the areas convinced him that adequate protection could not be had without covering the entire lowland area lying in the southern end of Philadelphia and southward and westward to the high ground, involving a surface of about 9,100 acres.

Practically all this area had been put under dike many years ago for agricultural purposes and the most of it is still thus protected. As is usually the case, shrinkage followed until at present the lower parts are 30 inches below mean high tide. Wherever the dikes have been broken the marsh area is covered at every high tide. An old drainage system of main ditches and tide-gated outlets had been installed and some parts of this system were still in working order. Over the larger part, however, the drainage systems had been neglected until the drainage obtained was entirely inadequate, the soil was full of water and in many places completely hidden by sheets of water.

The first problem was to get a reasonably accurate survey made. In the course of a meeting held at Hog Island in the quarters of Mr. George W. Roddy, director of sanitation, which was attended by Dr. John Reilly, chief surgeon of the International Shipbuilding Corporation, Mr. George W. Roddy, director of sanitation, Dr. B. F. Royer, of the Pennsylvania State Department of Health, and Mr. J. H. Neeson, assistant engineer, Department of Public Works, of the City of Philadelphia, the entomologist suggested: (1) that the whole area of lowland should be handled as a unit; (2) that for purposes of survey, it should be arbitrarily divided into four parts—one of which should be assigned to the Westinghouse Company, one to the Pennsylvania State Department of Health, one to the City of Philadelphia and one to the International Shipbuilding Corporation; (3) that each group for the area assigned to it should lay out a system of drainage which would remove the surface water and keep it off even under conditions of heavy rainfall or tidal inundation; (4) that after this was completed, the plans should be assembled in a meeting of the representatives of the groups concerned; (5) that these plans including estimates should then be unified and correlated by the Pennsylvania State

Department of Health; (6) that a meeting of the fiscal representatives of all the parties concerned should then be called and an effort be made to raise the necessary funds to carry out the project. These suggestions were accepted at this meeting as a satisfactory basis for procedure and were duly carried out. The plans when completed involved the expenditure for permanent and temporary work for the first year of $215,000. At the meeting of the fiscal agents most of this money was pledged and the work started. It was agreed that the work should be carried on under the direction and supervision of the Pennsylvania Department of Health as represented by Mr. C. A. Emerson, Jr., chief engineer of the Pennsylvania Department of Health. Mr. W. V. Becker, chief inspector of the Nassau County Mosquito Extermination Commission of Long Island, New York, was employed to take immediate charge and the work is now going forward.

Wilmington Shipyards

At the request of Col. Philip S. Doane, chief of sanitation and health of the Emergency Fleet Corporation, and with the consent of his superiors, the entomologist made a study of the mosquito problem about the shipyards at Wilmington, North Carolina. He found three yards either in process of construction or already at work; one for the construction of fabricated steel ships, one for the construction of concrete ships and one for the building of wooden ships. The problem at this point appeared to be concerned with the control of the breeding of malarial mosquitoes, house mosquitoes, fresh-water swamp mosquitoes, yellow-fever mosquitoes and salt-marsh mosquitoes.

The city of Wilmington, with about 30,000 people, presented the usual back-yard problems. Within easy flight range of the yards and of the city, there are some cypress swamps in which behind screening plants and in old cypress stumps the malarial species can breed. Just across the river from the city of Wilmington and the yards, and within easy flight range, lay 11,000 acres of old rice land, the protecting dikes and drainage ditches of which have been neglected until they serve rather to create than to eliminate mosquito-breeding places. Scarcely an acre of this entire body of land is under cultivation and was, at the time of the visit, overgrown with rank grasses and weeds. Within easy flight range of the city and yards lay 10,000 acres of salt marsh.

It was proposed that an organization for fighting the mosquito pest be created and that the work begin in the shipyards and the city, and work outward as fast as time and funds would permit.

In cooperation with Mr. Le Prince and Mr. Harold I. Eaton, of Public Health Service, the entomologist presented the nature of the problem to a large group of business men in the city of Wilmington, and advised the raising of $30,000 of local money to start the work. At this meeting this sum of money was raised and provisions made whereby an organization could be created. It was decided to place the conduct of the work under the general direction of the health officer of the city of Wilmington. The organization has now been created and the work is going forward.

Other Services Rendered to the Emergency Fleet Corporation

With the consent of his superiors, the entomologist has been made Consulting Mosquito Expert for the Emergency Fleet Corporation attached to the office of Sanitation and Health of that government organization, and is at the call of the chief, Col. Philip S. Doane.

Mosquitoes of the Year

In early May the usual brood of salt-marsh mosquitoes emerged from the undrained and incompletely-drained marshes. This brood was unusually large and troublesome. The only part in the drained area in which a brood of any size appeared was a small portion of the Union meadows, a considerable portion of the Hudson County meadows lying west of the Hackensack River and north of the Harrison Turnpike and from certain wooded areas from the Bergen marsh. This emergence was sufficient to carry salt-marsh mosquitoes into Montclair and Paterson. Fortunately, the weather was cool and the mosquitoes were relatively inactive.

A second brood emerged mainly from the Hudson areas in June and reached northern Essex and Passaic. As has been the experience in the past, practically no *sollicitans* appeared in the first brood in the northern half of the state and the species concerned was *cantator.* In the south, the brood was composed mainly of *cantator* but showed a considerable percentage of *sollicitans.* The second brood in the south was largely *sollicitans* and in the north showed a small percentage of *sollicitans.* The rest of the brood was composed of *cantator.*

Sylvestris was rather slow in getting started during the present season and did not appear in considerable numbers up to the close of the present fiscal year. To the close of the present fiscal year, *pipiens* was entirely negligible.

Financial Statement

Appropriation		$15,000.00
Salt-marsh ditching	$9,600.00	
Advertising for proposals	34.44	
Photographic supplies and blue-prints	106.25	
Repairs to motorcycle	59.76	
Telephone and telegraph	9.00	
Postage	40.00	
Salaries and wages of regular and temporary employees	2,582.20	
Travelling expenses	572.56	
Reverting to the state treasury as the result of shortening of the year by reason of legal change in the fiscal year	1,995.79	$15,000.00

REPORT OF THE DEPARTMENT OF PLANT PATHOLOGY

Department of Plant Pathology

MELVILLE T. COOK, PH.D., *Plant Pathologist.*

*WILLIAM H. MARTIN, A.B., *Research Assistant.*

†ROBERT F. POOLE, B.SC., *Research Assistant.*

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*Resigned January 15, 1918, to enter military service.
†Resigned November 15, 1917, to enter military srevice.

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Report of the Department of Plant Pathology

M. T. Cook

ORGANIZATION

The organization has been very much changed since our last report. Mr. C. M. Haenseler, who held the New Jersey Zinc Company fellowship, was called to the colors in September and is now in France with a regiment of Forestry Engineers. Mr. R. F. Poole, who came to us from Clemson College, S. C., May 1, 1917, as fellow and assistant, enlisted in November and is in France as photographer in the Aviation Corps; Mr. W. H. Martin, fellow and assistant, completed his work for the Ph. D. degree in January and enlisted in the Aviation Corps; Mr. F. P. Schlatter, who was doing minor work in the department, is in the photographic division of the Aviation Corps; Mr. C. A. Schwarze, State Nursery Inspector, resigned June 1, 1918.

This left the department without help, but fortunately the Office of Cotton, Truck and Forage Crop Disease Investigations, of the United States Department of Agriculture, assigned Dr. L. M. Massey to us for extension work in plant pathology. He had his undergraduate training at Wabash College, from which he was graduated in 1912, and took his Ph. D. degree at Cornell in 1916. Mr. Erdman West has been employed by the State Department of Agriculture as assistant nursery inspector, beginning work June 1, and is stationed here. He was graduated from the Pennsylvania State College in 1917.

1918 WORK

Because of war conditions we are planning to do less research than usual and to give more time to the immedate needs for food production. Dr. Massey will give special attention to tomatoes, peppers and sweet potatoes, but will respond to calls for advice and assistance in the control of plant diseases in general throughout the season. The demands for his time are already greater than can be met

RESEARCHES

1. The research work on fungi injurious to paint must necessarily be discontinued for the present. The future for this work was very promising at the time Mr. Haenseler was called away.

2. The research on the disease of celery must also be dropped for the present. This is a very promising line of work and should be continued as soon as possible. The work to date demonstrates (a) that seed-bed treatment is very important and profitable, (b) that crop rotation is advantageous, (c) that we should have more data covering soil treatments with fertilizers and other chemicals in the field, and (d) that spraying is profitable when well done.

3. The tomato spraying work will be continued on the farm of the Campbell Soup Company at Riverton, N. J., by the Office of Cotton, Truck and Forage Crop Disease Investigations of the United States Department of Agriculture; this office cooperating.

4. The studies on the transmission of potato diseases through seed tubers is being continued on the College Farm.

5. The potato spraying work also is being continued.

6. Because of the number of complaints in 1917 concerning a bacterial corn disease, we will make tests in cooperation with Prof. bacterial corn disease, we will make tests in cooperation with Dr. G. N. Hoffer, of the Indian Agricultural Experimental Station, who has been studying this problem for some time.

SEED-BED DISEASES

During the spring of 1918 we had more complaints than usual concerning *damping-off* in seed-beds. Losses of this kind cannot be estimated with accuracy but were no doubt much greater than is generally supposed even by those who are familiar with the facts. They undoubtedly resulted in delays in planting and reduced acreage of certain crops.

There are several organisms which cause *damping-off* in the seed-bed and some of them continue to thrive and cause losses in the field. This is especially true of *Sclerotinia Libertiana* which attacks lettuce, celery, beans, cucumbers and many other plants.

These troubles can be controlled very readily and at a very slight expense. It is one of the most profitable propositions for the vegetable grower. Unfortunately, the loss of men during the year made it impossible for us to take up this work. It should be taken up as an extension project before the time for making seed-beds for another year.

DISEASE-RESISTANT PLANTS

There is an increasing amount of evidence to show that certain types of plants can be controlled to the best advantage by the development of resistant strains or varieties. This is especially true of those disease, in which the casual organism works within the host and therefore cannot be reached by sprays or other external treatment. Results throughout this country show that it is possible practically to eliminate many diseases in this manner. However, the results also show that resistant strains which are satisfactory for one section of the country may be neither resistant nor satisfactory in another section. It is the opinion of the writer that one of the most important and profitable lines of work for New Jersey would be a series of experiments for the purpose of developing resistant varieties. The most urgent problems of this kind at the present time are with tomatoes, cabbage, celery and alfalfa.

NEEDS

The most important demands for special studies at this time are as follows:

1. Studies on pathogenic organism in the soil and the best methods for their control. This involves the problem of seed-bed sterilization referred to above.
2. Studies for the development of varieties of crop plants resistant to diseases, especially for those diseases for which there is no other known method of control.
3. Studies on potato diseases for the purpose of determining (a) the extent to which certain diseases are carried in or on the tubers, (b) the extent to which diseases are eliminated by the growing of very late crops to be used as seed the following year, and (c) the extent to which the foliage diseases can be controlled with profit by spraying.
4. Studies of the *mosaic* and other diseases of the tomato.
5. Studies on the wilt of eggplant.
6. Studies on the diseases of celery.
7. Studies on the diseases of legumes, especially alfalfa.
8. Studies on the diseases of shade and ornamental plants.
9. The importance of plant disease organisms as destroyers of perishable products in storage and during shipment is attracting a great deal of attention at this time and some steps should be taken to bring the facts before our New Jersey producers and to pursue studies along this line.

The Herbarium

Unfortunately our herbarium has been neglected for several years. The mounted plants should be gone over carefully and arranged in accordance with the up-to-date researches in taxonomy. Several hundred unmounted plants should be mounted and properly distributed so that they can be used to advantage.

PUBLICATIONS

The following publications have been issued November, 1917.

Circular 88. Common diseases of berries. Mel. T. Cook.
Circular 89. Common diseases of garden vegetables and truck crops. Mel. T. Cook.
Circular 93. Spray calendar for apples and quinces. T. J. Headlee, M. T. Cook, M. A. Blake and A. J. Farley.
Circular 94. Spray calendar for the peach. T. J. Headlee, M. T. Cook, M. O. Blake, and A. J. Farley.
Circular 95. Seed and soil treatment for the control of potato scab. H. Clay Lint.
Circular 96. Leaf blight of the tomato. Mel. T. Cook and W. H. Martin.
Circular 97. Common diseases of ornamental plants. Mel. T. Cook.
Martin, G. W., 1918. Brown blotch of the Keiffer pear, *Phytopathology*, v. 8, p. 234-240.

LIST OF PLANT DISEASES

Having published a list of the plant diseases of 1917 in our last report we have very few to add at this time. We consider it advisable to withhold this brief list and incorporate it in the next annual report.

PLANT DISEASE SURVEY

The United States Bureau of Plant Industry has established a Plant Disease Survey which is being conducted in cooperation with the departments in the different states. This work of the department is of the greatest importance, especially at this time. Had much of the information which we are now gathering been available at the beginning of the war, it would have been an important factor in the food production of our country.

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